SPECIAL TACTICS

SMALL UNIT

MACHINE GUN EMPLOYMENT

MACHINE GUN THEORY AND TACTICS FOR INFANTRY SQUADS AND PLATOONS

DEVELOPED BY SPECIAL OPERATIONS & INFANTRY VETERANS

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SPECIAL TACTICS™

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To those who have gone before us, the living and the fallen

COURSE OVERVIEW
Machine Guns and Infantry Combat

The machine gun is in many ways the backbone and most decisive weapon system in modern infantry units. Effective machine gun employment has made the difference between victory and defeat in countless modern combat engagements from the First World War to the War on Terror. However, despite how important machine guns are on the modern battlefield, there are remarkably few books and references that focus specifically on how machine guns work and how to use them on the battlefield. There are a fair number of official military machine gun manuals but many of these are many hundreds of pages long, difficult to understand and focus more on technical topics than how to use machine guns in real-world combat scenarios. This book aims to fill the machine gun knowledge gap and provide machine gunners with a short, simple but comprehensive reference that is easier to understand and apply to mission requirements.

Intent of This Book and Topic Overview

Most tactical books are intended for audiences of a specific proficiency level. Some books are useful for less experienced readers while some are geared towards individuals with more experience. This book should prove useful to both audiences. This book covers basic principles in detail and should be accessible and easy to understand even for those with little to no prior experience with machine guns. However, because the book focuses on topics not often covered in existing manuals, we expect that even the most experienced machine gunners will find useful information in the following pages.

One of the main focuses of this book is how information is presented visually to the reader. Machine gun employment is a physical skill that takes place on a three-dimensional battlefield. Many of the topics in this book are covered in other machine gun manuals but they are presented using only a few, small, black-and-white illustrations, making it difficult to visualize concepts and how they apply to real-world battle. This book takes the opposite approach and takes maximum advantage of large, color pictures and diagrams. We believe that machine

gunners and infantry leaders at all levels will find this visual learning approach both interesting and useful.

The book can be broken into four main parts. The first part covers machine gun fundamentals and theory, discussing topics like, unit organization, different types of machine guns and machine gun ballistics. The next part explains how to employ machine guns on the battlefield, discussing tactical concepts, fire control, control measures and specific techniques of fire and engagement. The final part focuses on how to fight and win with machine guns on the battlefield in real-world situations and how to train machine gun teams to achieve optimum levels of combat performance.

Subjects This Book Does Not Cover

The topic of machine guns and machine gun employment is extremely broad. As already mentioned, most official machine gun manuals are many hundreds of pages and they often still leave out many important and critical topics relating to tactics and real-world applications. It would be possible to fill many volumes focusing only on machine guns and their use on the battlefield. Therefore, to keep this book short, accessible, and easy to absorb, we have had to leave out many topics to concentrate on the essentials. We have paid particular attention to topics that are covered less frequently in existing manuals.

First, this book is not a technical manual and does not emphasize technical aspects of how a machine gun functions and how to aim, shoot, operate and maintain a machine gun as a gunner or assistant gunner. This book also does not go into detail on other scientific or technical topics such as advanced ballistics and optics. Rather, this book focuses on how machine guns fight and how they can effectively engage and destroy enemy forces on the battlefield. Therefore, this book is as much for leaders as it is for gunners and gun teams. Both the gun teams and the leaders who command them need to understand the bigger picture of how machine guns operate on the battlefield and contribute to victory in modern combat. In short, this is not a book about machine guns, it is a book about how to fight and win with machine guns.

Since the book is not a technical manual, it does not attempt to capture every aspect of the latest technology, optics, and official doctrine. The book uses examples of different weapon systems, equipment, and doctrinal systems but these examples are intended to highlight timeless concepts that can apply to any force, regardless of the specific machine gun, equipment, and doctrine they employ. Therefore, do not get overly fixated on examples in this book. Rather, attempt to understand the concept and then apply that concept to your own weapons, doctrine, and mission.

Diagrams and illustrations are also usually not intended to precisely reflect reality. The bullet trajectory in a diagram explaining machine gun ballistics might not perfectly conform to the laws of physics. However, the diagrams are designed once again to be easy to understand and to illustrate core concepts. Technical data and specifications in this book might not match every official manual. In truth, technical specifications on machine guns can vary even among U.S. Army manuals. Therefore, we encourage you not to overly focus on the numbers. If you use

different numbers and data in your organization, simply plug your numbers into the concepts in explained in this this book.

Who This Book is For and How to Use It

This book is also not only intended to be useful for machine gun teams and weapons squad leaders. Having a firm grasp and understanding of machine gun employment is critical for the mastery of platoon-level combat and company-level combat. Understanding of how machine guns fight on the battlefield is even useful for higher-level commanders at the operational and strategic levels. Even if you are in command of an entire corps or army, the actual calculus of victory or defeat plays out at the ground level, where individual combatants, teams and squads fight for survival in close combat. Machine guns are a critical part of this fight. Having a greater contextual understanding of the lowest levels of combat can be useful for higher-level commanders, especially if it has been a while since they have experienced warfare from the tip of the spear.

Just reading this book will not make you more effective at machine gun employment. You must practice the techniques in this book over and over as part of a more complete tactical training, weapons training, and fitness program in order to truly enhance your combat performance. While you can read this book from cover-to-cover for background, you will find that some sections are repetitive which is intended to make each section of the book self-contained. A more practical way to use the book is to reference the sections that are most relevant to you in the context of a larger training program. The book is designed to complement other books from Special Tactics as well as online courses and in-person training. Reading this book is only the beginning to becoming proficient at the art of machine gun employment.

One final note on terminology, this book sometimes uses the terms “troops” or “troopers” to refer to infantrymen. This is simply intended to make the book familiar and compatible with all military forces. For example, Marines specifically use the term “Marine” and never use the Army term of “Soldier” to describe their personnel. By using neutral terms, the passages in this book could be referring to any military force: Army, Marine, Navy, Air Force, Special Operations or NATO/Allied.

INTRODUCTION
The Four Pillars of Survival

The "four pillars" of survival are proper mindset, situational awareness, skill proficiency and physical fitness. These pillars form the basis for success in all combat situations. This manual is intended not only to teach specific techniques, but rather to increase the reader's actual chances of survival and success in a real-life combat situation. An expert marksman who is not mentally prepared for the stress of combat and not ready to employ lethal force can lose to an untrained adversary. Lack of situational awareness, even for a moment, can cause an experienced fighter to fall victim to unskilled enemies. Therefore, any combat training program must rest on the following four pillars.

Proper Mindset

Proper mindset is the most critical of the four pillars. In the simplest terms, people with the proper mindset devote significant time and energy to preparing for combat and training for the worst-case scenario. Many people will learn to shoot a pistol or study a martial art but their skills decline quickly because they fail to practice frequently enough. Having the proper mindset means being tough, determined, never cutting corners, and taking every precaution to ensure survival. In a combat situation, having the proper mindset means being prepared to employ lethal force without hesitation and never quitting during the fight regardless of fear or pain. The training suggestions in this manual will help you develop the proper mindset.

Situational Awareness

Lack of situational awareness is one of the leading causes of failure or death in combat situations. In modern society, most people's situational awareness is very low. They generally spend their day wrapped up in their own thoughts and problems and pay little attention to what is going on

around them. People who live in relatively secure environments fall into even deeper levels of complacency and unpreparedness. The mentality of, "it can't happen to me," can ultimately prove to be disastrously wrong. Most victims of crime, terrorism and other deadly attacks lived their lives thinking, "it can't happen to me."

People with the proper mindset understand the importance of situational awareness and make disciplined efforts to cultivate it. Situational awareness begins with awareness of the threat and awareness that bad things can happen to anyone. Situational awareness involves trying to remain alert at all times without being paranoid. In a combat environment, situational awareness includes conducting detailed area studies prior to deployment, following trends in enemy tactics and studying current intelligence reports. The best way to improve your situational awareness is to make a conscious effort to continually cultivate and improve it.

Skill Proficiency

Once you have the proper mindset and maintain good situational awareness, the next step is to ensure you have the proper skills or "tools" to protect yourself in a combat situation. When striving to improve skill proficiency it is important to choose the best skills and techniques that are simple, effective, easy to perform and can realistically apply to a real-life scenario. Then you must practice these techniques repeatedly until they become second nature. This will maximize the chances that you will respond immediately in a high-stress situation. The central focus of this manual is to help you build skill proficiency.

Physical Fitness

Fitness is a critical but often overlooked factor that affects your chances of survival in a combat situation. Even skilled fighters with the proper mindset and high levels of situational awareness can lose a fight simply because they run out of energy. In order to maintain adequate levels of combat fitness, you do not need to achieve the same fitness level as a professional or Olympic athlete. Rather, the key is merely to stay healthy, maintain a decent level of cardiovascular endurance, running speed, functional strength, and coordination. Popular commercial fitness programs don't always focus on the most useful abilities needed for combat. For example, many people jog but how many also run sprints to build speed? Simply being able to run fast without falling is one of the most critical survival skills in a gunfight or emergency situation, yet most people rarely practice sprinting. For those interested in combat fitness, Special Tactics provides a range of books and courses on the subject.

MACHINE GUN FUNDAMENTALS
Gun Types and Unit Organization

This section provides a brief overview of different types of machine guns and how to organize them into machine gun teams, infantry platoons and infantry squads. For demonstration purposes, the book primarily uses U.S. military doctrine and machine guns. However, the larger concepts discussed in the following pages could apply to any military force using any organizational structure and combination of weapons.

Advantages of Machine Guns

As already discussed, the machine gun is typically considered the most decisive and important infantry weapon, especially at the squad and platoon level. The firepower provided by a machine gun can sometimes be considered greater than the combined fire of an entire rifle squad. This is because of the machine gun's high rate of fire, greater range, and the armor penetration of the larger, faster machine gun bullets.

The rate of fire of the machine gun means it can send more bullets towards the enemy in a shorter period of time than a normal rifle fire. In a typical combat engagement, a single machine gun will fire as many bullets as might be fired by 6-12 riflemen during the same time period. This increased volume of fire can prove overwhelming for enemy forces. Even if enemy troops are not killed by a machine gun, the heavy fire laid down by a machine gun can suppress or fix an enemy force, rendering it ineffective. Also, while rifles are generally designed to engage one enemy trooper at a time, machine guns are ideal for engaging area targets or larger formations. A single burst of fire from a machine gun can cut down multiple enemy troops in an instant.

Machine guns can generally also engage targets at approximately twice the range of typical infantry rifles. This means that a force armed with machine guns will have a decisive advantage in long range combat against a force with fewer machine guns or no machine guns. This also means that in long range combat, a force that is better trained at machine gun

employment will likely defeat a force that is less proficient with machine guns. As we will discuss in later sections, at range, machine gun bullets do not travel to the target in a straight line but rather in an arc that ends with the bullets coming down on the enemy from above. This type of "plunging fire" can offer machine guns additional tactical advantages in many situations.

Machine gun bullets are also often larger, faster and have better armor penetration capability than other bullets. This means that machine gun bullets do more damage when they strike any target, whether it is an enemy trooper or a vehicle. This also means that a machine gun might be able to destroy or disable a truck or lightly armored vehicle with a single burst, when it would require a many riflemen firing numerous rounds simultaneously to disable the same vehicle. Machine gun bullets might also be able to penetrate or blast away covered positions that would protect troops from normal rifle fire.

Types of Machine Guns

Machine guns can generally be grouped into three types: light machine guns, medium machine guns and heavy machine guns. For the sake of explanation, we will use examples from the U.S. military. However, machine guns employed by other countries, particularly NATO countries will generally conform to the same categories. Automatic grenade launchers like the U.S. military's 40mm MK 19 are also considered machine guns but because their operation and employment differs in some ways from other machine guns we will not cover them in this book.

Light Machine Guns (LMGs) are often the same caliber as the standard squad infantry rifle. In the case of the U.S. military, the light machine gun is the 5.56 mm, M249 Squad Automatic Weapon (SAW). The SAW fires the same bullet as the M16 Assault Rifle or M4 Carbine out to a roughly similar range. However, the SAW fires at a much higher rate of fire. While the SAW is a machine gun, it is also employed in the traditional "automatic rifle" role like the Browning Automatic Rifle (BAR) in World War II. In simple terms, the SAW is light and maneuverable enough to be operated by one trooper and fired in a way similar to an assault rifle. This means the SAW can be used either in a traditional fire support role or as an assault weapon in a maneuver element. When fired from the prone position, the SAW is generally fired on a bipod.

5.56mm Light Machine Gun (LMG)	Unit Symbol

7.62 Medium Machine Gun (MMG)	Unit Symbol

Medium Machine Guns (MMGs) fire larger caliber bullets than LMGs. In the U.S. military, the medium machine gun is the 7.62mm M240B. Medium machine guns fire at a higher rate of fire than infantry rifles but also fire farther and offer better armor penetration. However, MMGs are also heavier and generally require at least a two-person machine gun team to operate consisting of a Gunner and an Assistant Gunner (AG). The AG is generally tasked with helping the gunner to set up the machine gun, attaching the ammo belt and ensuring the belt feeds into the weapon properly so that there are no malfunctions. The AG also helps the gunner by carrying some of the heavy 7.62mm ammunition.

The MMG can be employed either on a bipod or a tripod. The bipod makes it easier to put the gun into action quickly but offers less stability and long-range accuracy, especially on uneven or soft ground. The tripod offers greater stability and also allows for the attachment of a traversing and elevating (T&E) mechanism which gives the gunner the ability to conduct more complex calculations to accurately engage pre-determined targets at long range in limited visibility conditions. We will discuss employment of the T&E in more detail later on in this book. The AG is responsible for carrying the tripod and helping the gunner place the machine gun on the tripod in a combat situation.

.50-caliber Heavy Machine Gun (HMG)	Unit Symbol

Machine Guns (HMGs) fire even larger caliber bullets than MMGs. In the U.S. military, the HMG is the Browning M2HB .50-caliber. In some cases, HMGs will fire at slower rate of fire than MMGs and LMGs but they have the ability to fire much larger bullets at a much farther range. HMG bullets have much better armor penetration capability, especially when using armor piercing

ammunition. Therefore, HMGs have the capability to effectively engage and destroy lightly armored vehicles, aircraft, and lightly fortified positions.

HMGs are substantially heavier than MMGs to the point where they are difficult to carry and employ without vehicular transport. A dismounted HMG team typically needs at least 3 personnel, a gunner, an AG, and an ammo bearer. In the case of the M2HB, the gun itself is so heavy that it must be broken into two pieces for dismounted carry. The gun is distributed between two of the team members and the third team member carries the tripod. It can be helpful to add one or more team member to help distribute the load of the heavy .50-caliber ammunition. The M2HB cannot be fired effectively from a bipod and requires mounting on a tripod or other fixed mount for operation. Because the HMG can fire farther and more accurately, this makes the HMG even more effective when employed on the tripod with a T&E mechanism attached.

Ammunition

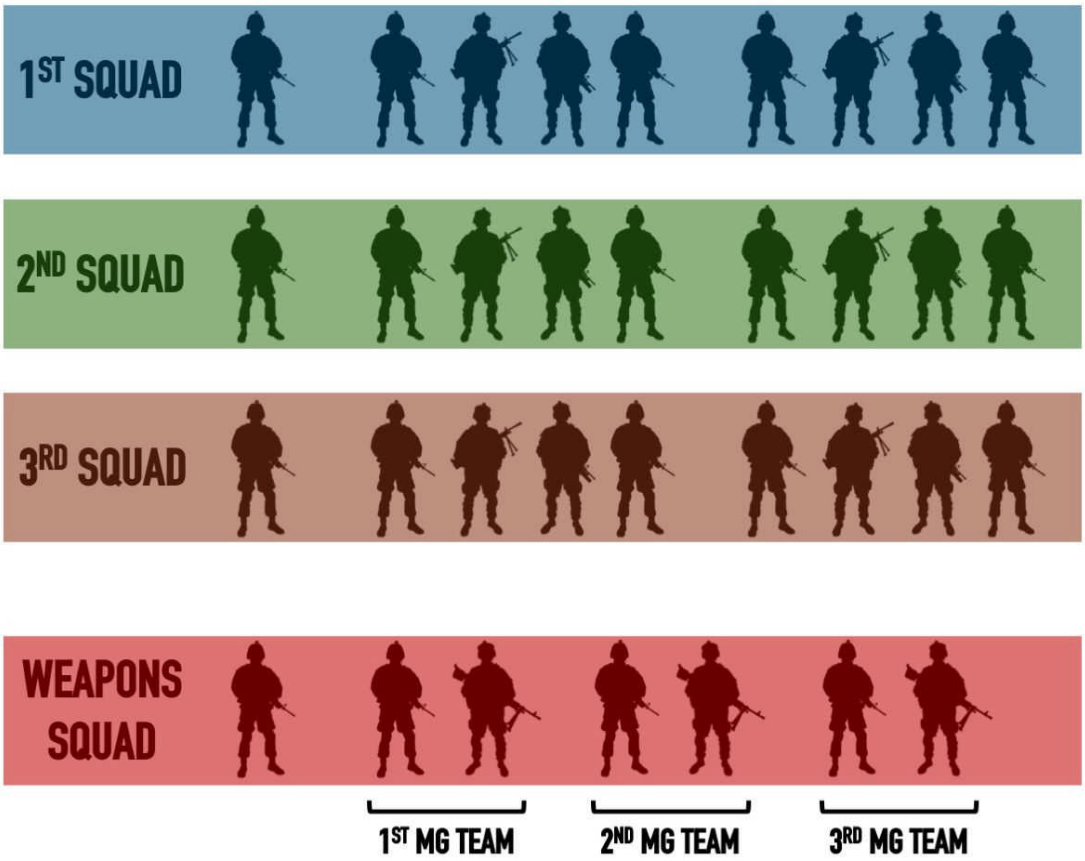
Machine guns can generally fire several different types of rounds. Most machine guns are belt-fed which means the rounds are attached in a way to feed through the gun rapidly as the gun fires. This also means it is possible to form belts with different mixes of ammunition. The most common types of ammunition are ball and tracer. Ball ammunition is either identical or similar to the standard rounds fired by other infantry weapons or assault rifles. Tracer ammunition contains a small pyrotechnic charge that lights up and leaves a "trace" through the air allowing the gunner to see where his/her bullets are going.

Larger caliber machine guns can often fire other more specialized types of ammunition. Some examples include armor piercing rounds which offer better armor penetration especially when targeting vehicles. Incendiary rounds are capable of starting fires, igniting fuel and are particularly useful against aircraft. Armor piercing incendiary rounds combine both armor piercing and incendiary capabilities. Tracer rounds also have some limited incendiary capacity. We will discuss how to employ tracers in more detail later in this book. These are just a few examples and general discussions of different types of machine gun ammunition.

PLATOON ORGANIZATION OPTIONS

Machine Gun Option 1: Separate Weapons Squad

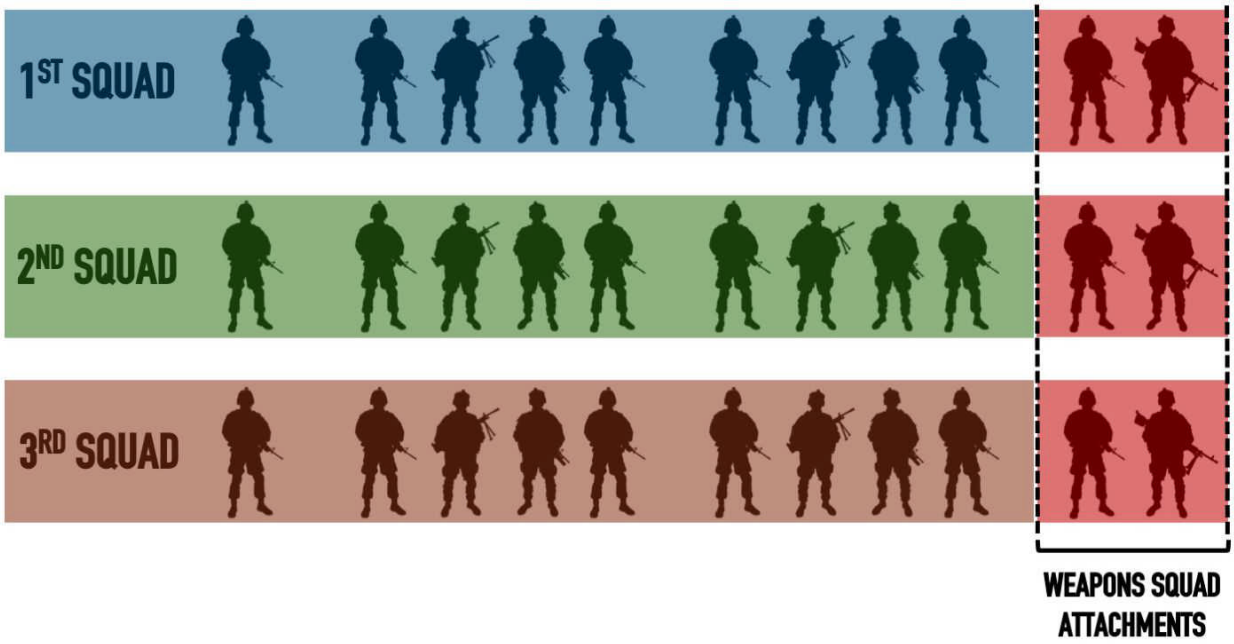
When assigning machine guns at the platoon level, there are a number of available options. Depending on the doctrine of your particular unit or organization, the machine guns will already be organized in a default, administrative configuration. However, most organizations will allow you to modify this organization. One common administrative configuration is to separate the platoon's medium machine guns (generally either 2 or 3) into a separate weapons squad led by a weapons squad leader who is typically the senior squad leader in the platoon. In some cases, you might want to retain this organizational structure in the field. For example, if your mission calls for deliberate massing of supporting fires for a larger scale attack, it might make sense to keep all the machine guns together so the weapons squad leader and other platoon leadership can carefully control the machine gun fire. However, in most cases it will make more sense to split the guns up in various ways among the other squads. Note that the squad sizes and configurations below are based on U.S. Army doctrine but the same principles explained in this section can apply to a squad of any size or configuration.



PLATOON ORGANIZATION OPTIONS

Machine Gun Option 2: Evenly Distributed

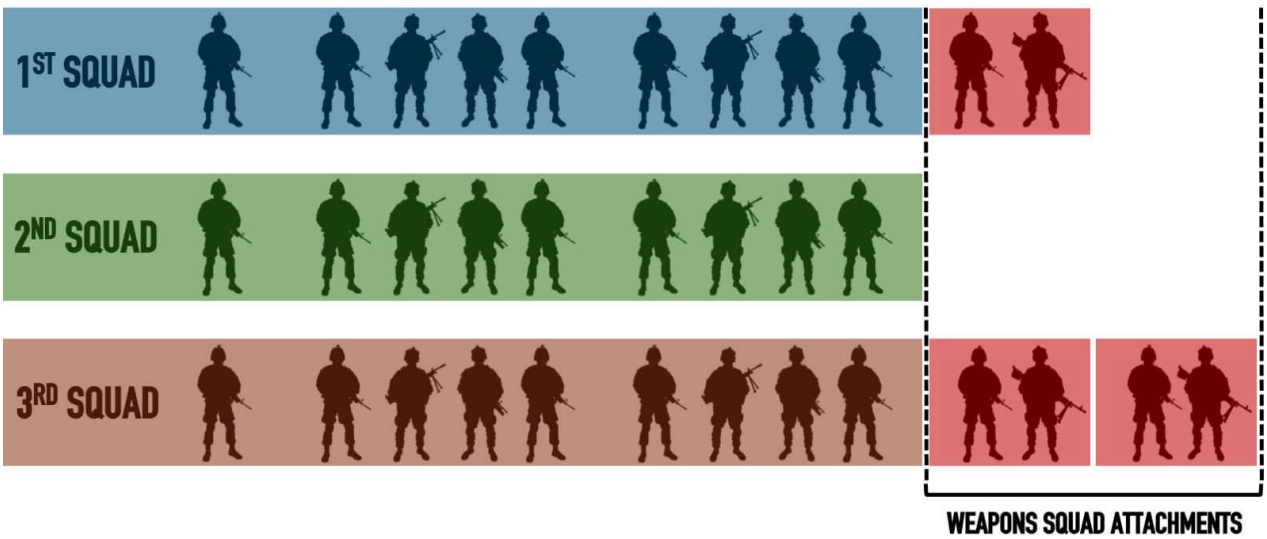
One commonly used option for organizing machine guns in the platoon is to assign one gun team to each squad. The main advantage of this option is that if offers tactical flexibility to the platoon while maneuvering. Because firepower is evenly distributed, the leader can pick any squad to act as the support element and any squad to act as the maneuver element and switch these responsibilities as needed without loss of effectiveness. However, while this configuration offers more flexibility, it means that no one squad will have an advantage in firepower, making it more difficult for the leader to mass fires at a specific time or place. The weapons squad leader can move freely much like the platoon leader or platoon sergeant, attaching to any element in order to best control the various gun teams.



PLATOON ORGANIZATION OPTIONS

Machine Gun Option 3: Unevenly Distributed

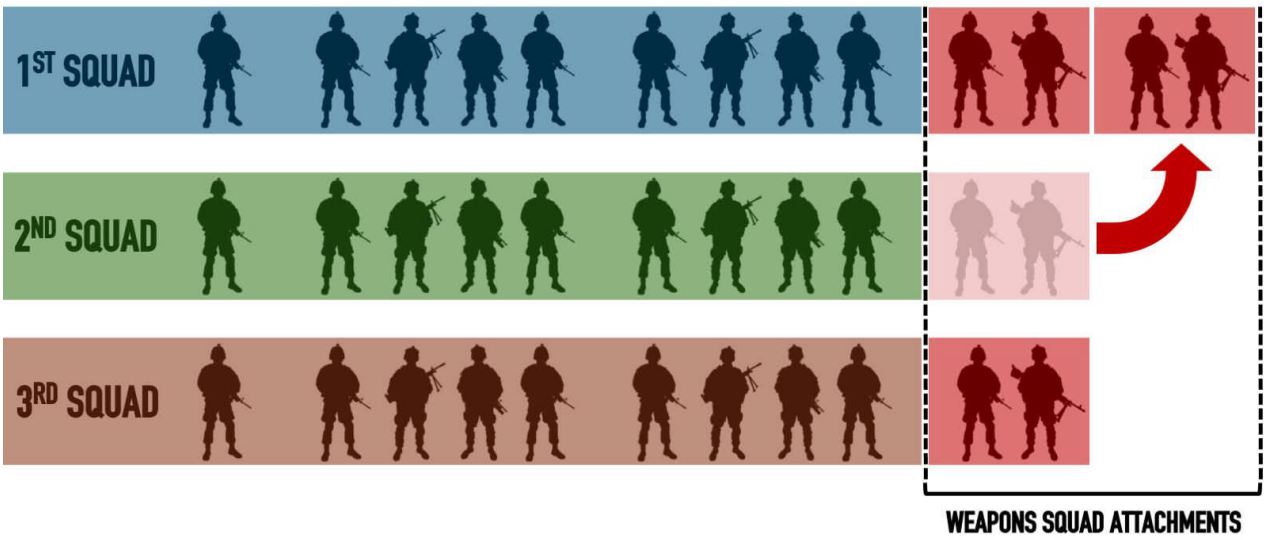
There might be times when a leader wants to concentrate firepower in a specific squad. One example of this is if the leader wants to designate a particular squad to focus on being the support element during combat maneuvers. Adding an additional gun or even all three guns to this squad will give the squad additional firepower in its supporting role. Having gun teams closer together will also make it easier to control, coordinate and mass their fire in more complex maneuvers. However, adding an additional gun to one squad means taking that gun away from another squad. This squad will lose firepower but gain some additional mobility since it will not be weighed down by the gun and ammunition. One common way to assign responsibilities in this situation is for the squad with no gun to act as a scout/recon element, the squad with two guns to act as the support element and the squad with one gun to act as the assault element. This is just one example and there are many different configuration possibilities. When guns are unevenly distributed, the weapons squad leader can still move freely as needed but it might make sense for him/her to attach to the squad that has the most guns in order to better direct their fire.



PLATOON ORGANIZATION OPTIONS

Permanent vs. Flexible Attachment

Whichever of the previous configurations you choose to adopt, the next question is whether that configuration should be permanent or flexible. This is not an all-or-nothing decision and you can decide to make the assignments more permanent, more flexible, or somewhere in between. The key question is how often do you move the gun teams around to different squads. The advantage of keeping the same gun team with the same squad is that specific squad and gun team will learn to work together very well over time. The disadvantage is that if a certain gun team gets used to working with one squad but then must move to another squad, there might be some confusion or loss of effectiveness since the gun team has never practiced working with a different squad. If you move gun teams around often, you might not get the tightly knit relationships between squads and gun teams, but the gun teams will be more used to moving around flexibly as needed. Once again, you do not have to chose one option or the other. What is important is knowing the advantages and disadvantages of each option and making the best assignment decisions based on your specific needs and mission.



SQUAD ORGANIZATION OPTIONS

Machine Gun Option 1: Independent

There is no single right answer for where to assign an attached machine gun within a squad. Each option has advantages and disadvantages. One option is to keep the machine gun separate from the teams. In this situation, it is usually best for the squad leader to also be independent so he/she can control the gun and position it at the most advantageous location on the battlefield. Note that in squads with multiple machine guns, you might employ both independent and integrated guns. An example of this is the U.S. Army rifle squad where the light machine guns are integrated into the teams but the medium machine gun is generally independent and remains with the squad leader.

ADVANTAGES
- Machine gun remains flexible and can be positioned anywhere or attached to either team as needed - Squad leader can maintain direct control over the positioning and employment of the machine gun
DISADVANTAGES
- Emplacing the gun can cause a momentary delay when maneuvering - Without a dedicated team in direct support, the machine gun is more likely to run out of ammunition

SQUAD ORGANIZATION OPTIONS

Machine Gun Option 2: Integrated

Another option is to keep the machine gun with one team. The machine gun can be assigned either to the squad leader's team or the assistant squad leader's team and can move either in the lead or in trail. Note that even if the machine gun is integrated into a particular team that does not mean that the gun cannot be assigned to the other team as needed. Still, it is more difficult for the gun to move back and forth between teams as it does when independent. Integrated machine guns are also the norm for units that employ unbalanced teams where one of the teams is a smaller support element. The gun will naturally be assigned to the support team.

ADVANTAGES
- One team can focus on supporting the gun's employment, carrying extra ammunition etc. - Allows for quicker reactions and maneuver - Leaves the maneuver team lighter and more mobile
DISADVANTAGES
- Less flexibility since the machine gun is pre-assigned to one team - Having the machine gun either in the trail or the lead can limit maneuver options

MACHINE GUN FUNDAMENTALS
Ballistics and Bullet Trajectory

In order to understand how to effectively employ machine guns on the battlefield, it is necessary to have at least a basic understanding of how machine guns work, not so much in terms of their mechanical components but rather how they are designed to fire bullets through the air to destroy enemy targets. This subject is sometimes called "machine gun theory" and begins with a study of machine gun ballistics and bullet trajectory.

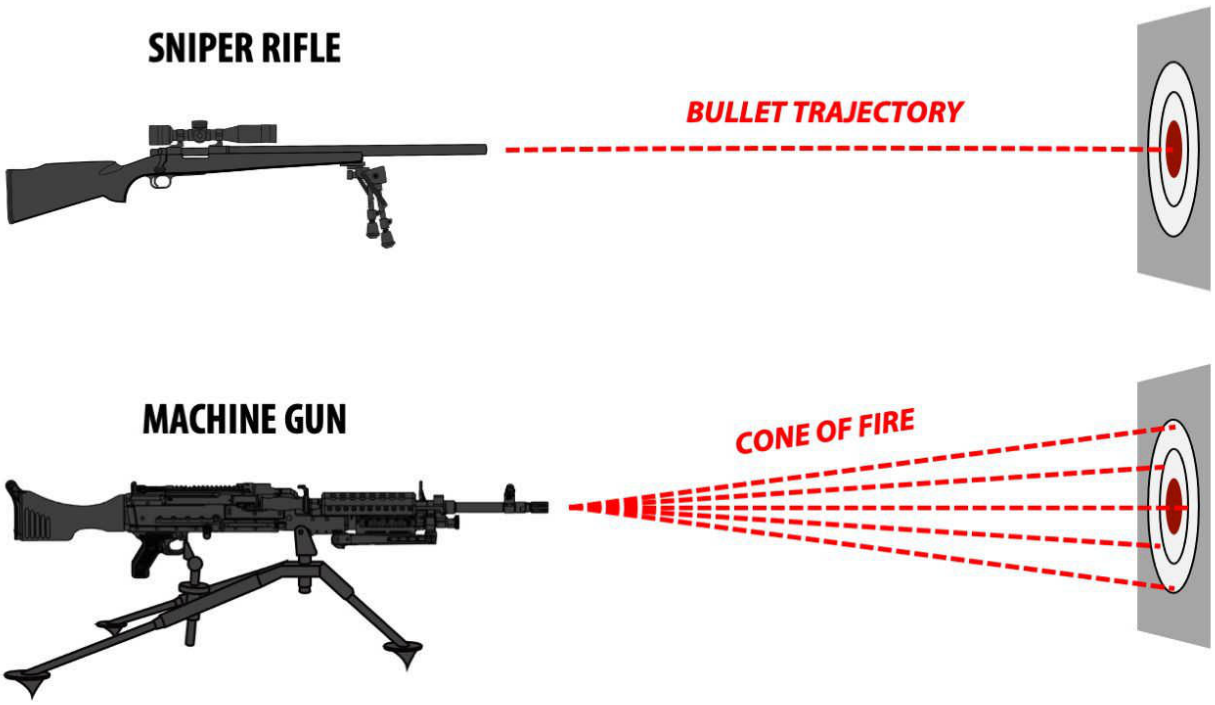
Ballistics is essentially the study of projectiles and how they fly through the air according to the laws of physics. When a machine gun bullet fires, it is traveling very fast, which means it has a lot of kinetic energy. Kinetic energy is the energy of motion. The faster a bullet is moving and the heavier the bullet is the more kinetic energy it has. When the bullet strikes a target, it transfers this kinetic energy into the target causing damage. Obviously, bullets are very dangerous, but they are not dangerous when you are holding them in your hand. It is a bullet's speed (kinetic energy) that makes it dangerous.

This explanation along with the following discussions of ballistics are very simplified. Our purpose here is not to provide an advanced physics lesson but rather to cover only the essential concepts behind machine gun ballistics in a way that is easy to understand. Every concept we cover in this section has direct applications to the battlefield and making decisions in a firefight. Some lessons on machine gun theory go into much greater detail, breaking down bullet physics into complex calculations and providing specific formulas for how bullets will impact a target at various ranges. While such calculations can be useful, particularly for snipers, a simplified and generalized understanding of ballistics is more appropriate for the purposes of this book.

MACHINE GUN BALLISTICS: CONE OF FIRE

Machine Gun vs. Sniper Rifle

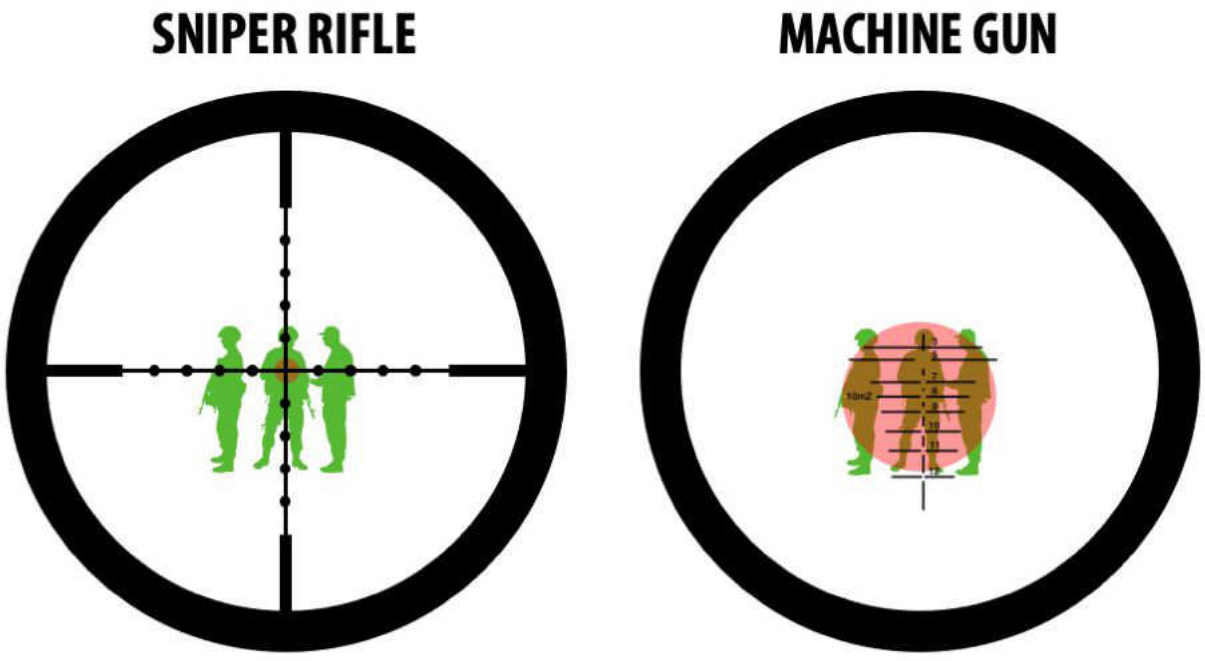
One of the first concepts to understand when learning about machine guns is the cone of fire. If you point a machine gun at a target and hold down the trigger, the bullets will not all go through the same hole. Rather they will spread out across the target. Part of this spread can relate to recoil and shooter stability. However, even if you place the gun on a tripod or in a vice, the gun will still spray bullets in a cone shape (see diagram below). The gun is actually designed to produce a cone of fire. In comparison, a sniper rifle is designed for pinpoint accuracy. If you put a sniper rifle in a vice and pull the trigger repeatedly, it will fire each bullet through the same hole, or at minimum the shots will be in a tight group depending on the range of the target. Therefore, while the sniper rifle is designed to be accurate, it could be said that the machine gun is designed to be inaccurate to a point. Note that the diagrams below are exaggerated for demonstration purposes and do not reflect actual ballistics.



MACHINE GUN BALLISTICS: CONE OF FIRE

Point Target vs. Area Target

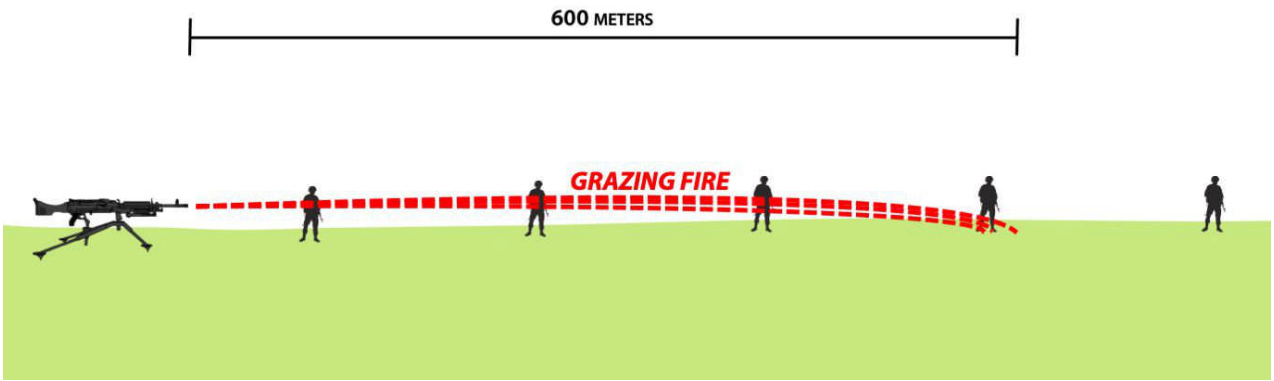
In the previous section we mentioned that it could be said that the machine gun is designed to be inaccurate. Why would this be? To answer this question examine the diagrams below depicting the view through a sniper optic and machine gun optic. Note that the illustration is generalized for demonstration purposes. If the sniper rifle shoots at the three troops standing in the crosshairs, the bullet will strike only the center trooper. If someone designed a machine gun that was as precise as a sniper rifle and you squeezed off a 9-round burst aiming at the center trooper, all 9 bullets would go through that one trooper. It is not logical to shoot the same target 9 times when two other targets stand untouched on either side. With this in mind, observe the example to the right. Because the machine gun is designed to produce a cone of fire, if you squeeze off a 9-round burst at the three troopers in the picture, depending on the range, there is a strong chance that at least one bullet will hit each target. In summary, the machine gun's cone of fire allows you to engage an area target and potentially hit multiple enemies with a single burst of automatic fire.



MACHINE GUN BALLISTICS: GRAZING FIRE

Grazing Fire – Trajectory and Range

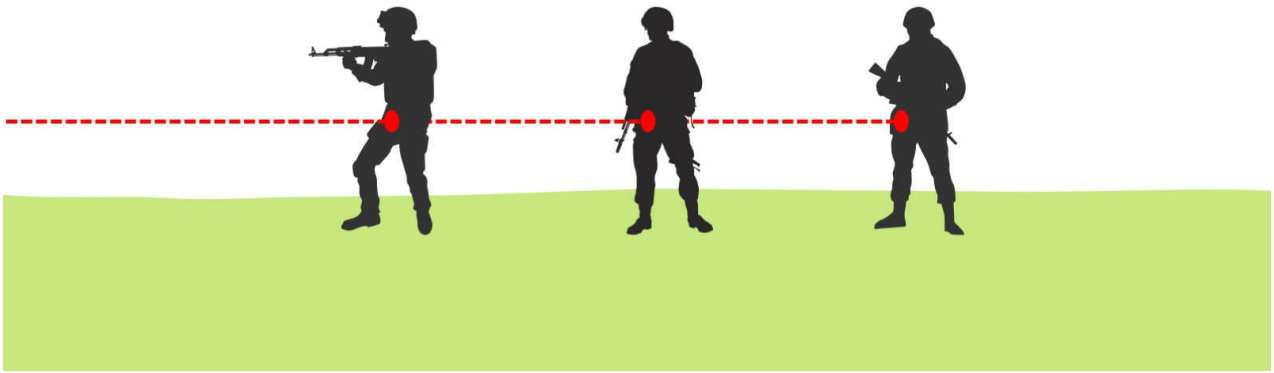
If you point the machine gun horizontally at a target that is less than 600 meters away, the bullet will travel in a fairly straight trajectory and strike the target. However, the bullet is actually not flying in a straight line (we will discuss this more in coming sections) but is rather traveling in an arc. When you fire a bullet from the machine gun it will obviously not continue on forever but will instead begin to lose energy and the force of gravity will cause the bullet to drop to ground level. If you fire an M240B medium machinegun roughly horizontal with the ground, the bullet will travel about 600 meters before hitting the ground. This is called "grazing fire" because the bullet is essentially grazing along the surface of the earth. Grazing fire travels in a generally straight line and in the example below, it would hit any of the four enemy troopers on the left since they are within 600 meters. However, the bullet will hit the ground before it reaches the enemy trooper standing on the far right side of the diagram. The maximum effective range of the M240B machine gun is 1800 meters, so how can we engage the enemy trooper on the far right? We will answer that question later in this section.



MACHINE GUN BALLISTICS: GRAZING FIRE

Grazing Fire – Advantage of Hitting Multiple Targets

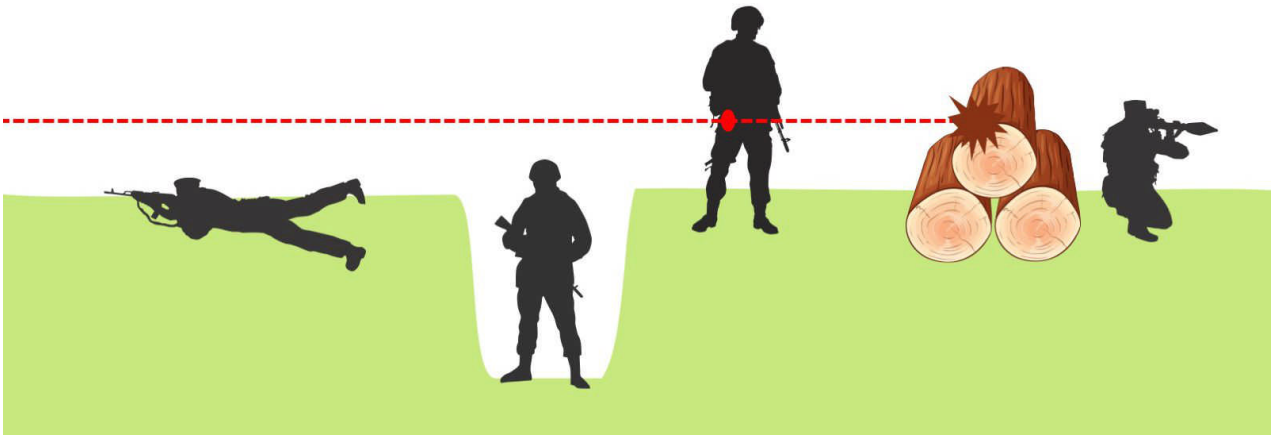
One advantage of grazing fire is because bullets are traveling in a relatively straight line along the ground, there is the potential of the same bullet to pass through multiple targets before it runs out of energy. This means that if there is a group of enemies coming towards you in a single file, if you fire a long burst at the target your cone of fire will pass through the entire formation. A bullet that does not strike the first enemy might strike the second or third. In addition, as already mentioned, a single bullet might pass through multiple enemies. We will discuss the tactical applications of this concept in greater detail later in this book.



MACHINE GUN BALLISTICS: GRAZING FIRE

Grazing Fire – Limitations Against Covered Positions

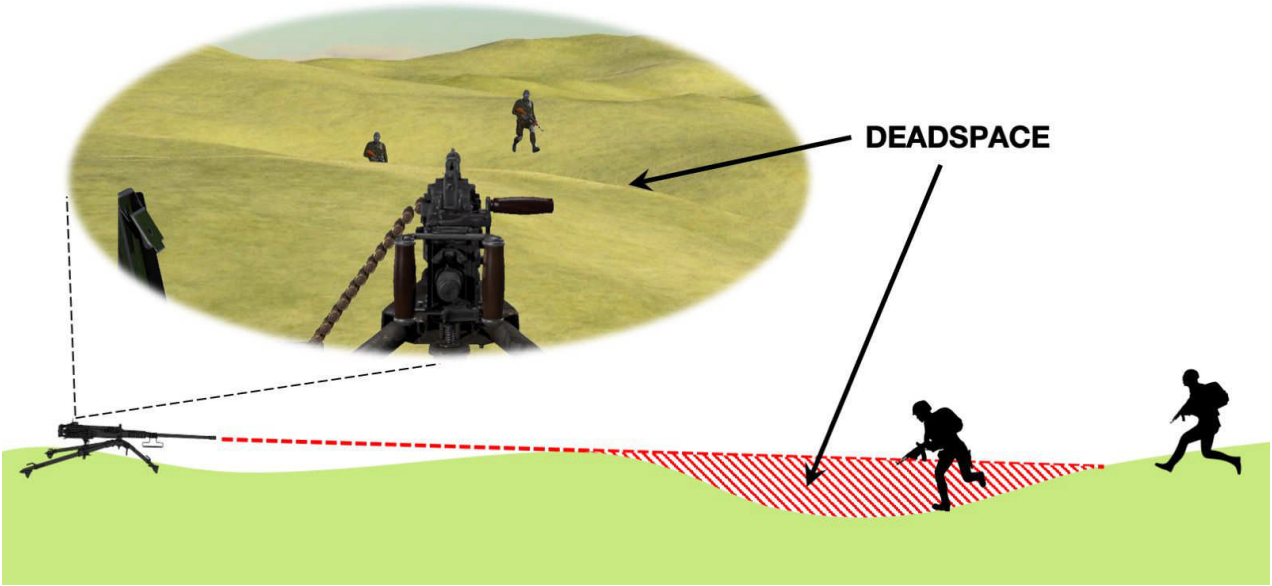
The fact that grazing fire travels in a roughly straight line along the ground offers an advantage when engaging linear formations in the open. However, this advantage turns into a disadvantage when trying to engage enemies in covered positions. Consider the example diagram below that depicts four enemies, one lying prone, one in a foxhole, one standing in the open and one hiding behind a stack of logs. A burst of grazing fire traveling along the ground only has a reasonable chance of hitting one out of four of these enemies, the one standing in the open. If you recall in the previous example, a burst of grazing fire was able to target multiple enemies standing in the open. However, this illustration emphasizes the point that grazing fire will often pass over the heads of prone or covered enemies and will impact enemy defenses before it can strike the enemy troops hiding behind them. It is also important to note that while grazing fire might not actually hit all of the enemies in the example below, it will probably force them to keep their heads down and make it more difficult for them to return effective fire. This effect is called suppression. When an enemy is suppressed he has to keep his head down or risk being shot. To add to this suppression value, it helps to keep grazing fire no more than 1-meter off the ground.



MACHINE GUN BALLISTICS: DEAD SPACE

Areas that You Cannot See or Engage with Direct Fire

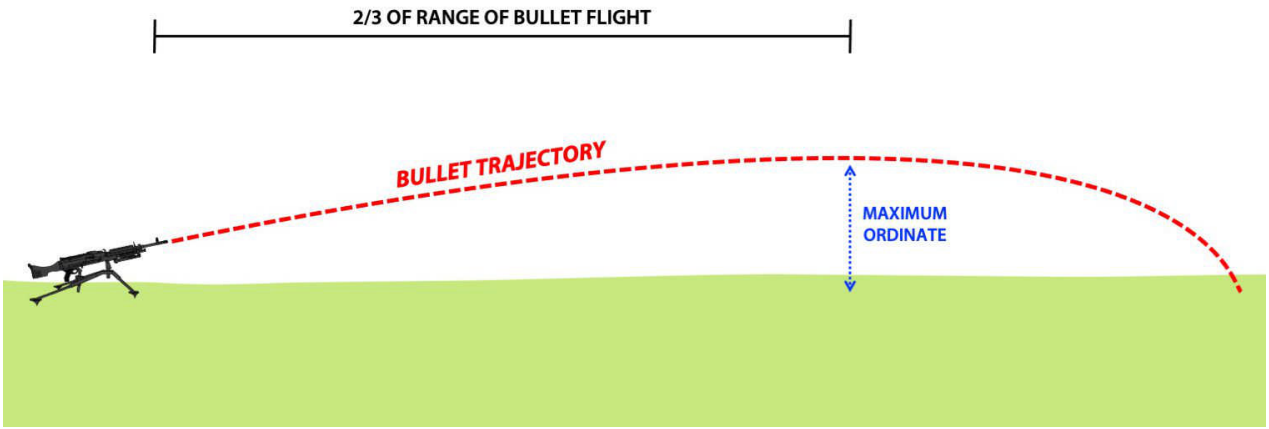
As discussed in the last section, when you are engaging targets with grazing fire (bullets traveling in a nearly flat trajectory) you may not be able to engage targets that are dug in, hiding behind cover, or hidden in low ground. This relates to the concept of dead space. Areas that you cannot directly see or engage where enemies could be hiding are called dead space. Examples of dead space might be the space behind a small hill, large boulder or fallen log. As in the example below, dead space might also be dips in the terrain. In the example below the gun can only see the upper half of the enemy on the left but can see the entire body of the enemy on the right. If both enemies lay down, the machine gun could only see and engage the enemy on the right. This is an example of dead space. We will discuss more about dead space and its tactical applications in later sections.



MACHINE GUN BALLISTICS: BULLET TRAJECTORY

Bullet Trajectory and Maximum Ordinate

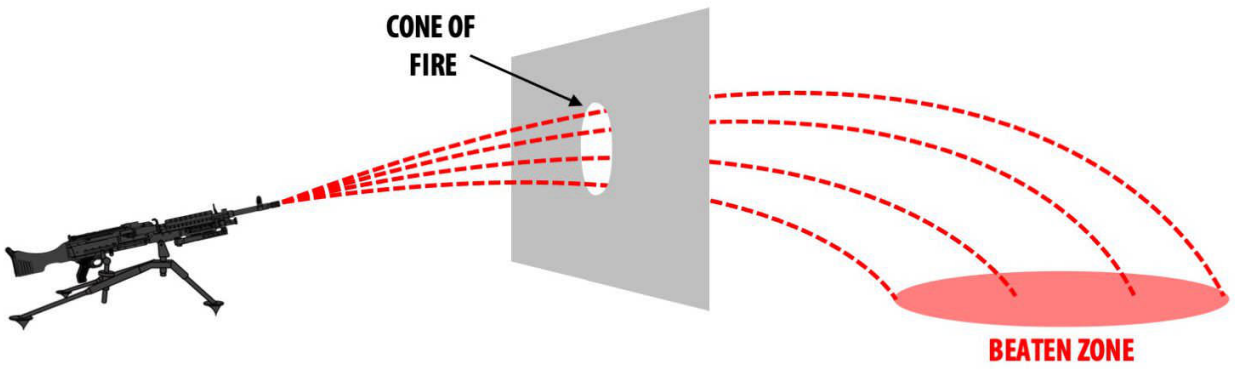
Earlier in this section we discussed how grazing fire (bullets flying along the ground) only reaches out to 600 meters when firing an M240B. To understand how to engage targets that are farther away than 600 meters we must first understand more about bullet trajectory. As already mentioned in our discussion of gazing fire, when you fire any bullet from a gun it does not travel in a straight line but is rather subject to the forces of gravity and drag, just as when you throw a ball through the air. When you fire a bullet it travels upward along an arc-shaped trajectory until it reaches the highest point (or maximum ordinate) around 2/3 of the way along the trajectory. The bullet then begins to drop downward until it impacts the ground.



MACHINE GUN BALLISTICS: BULLET TRAJECTORY

Cone of Fire and the Beaten Zone

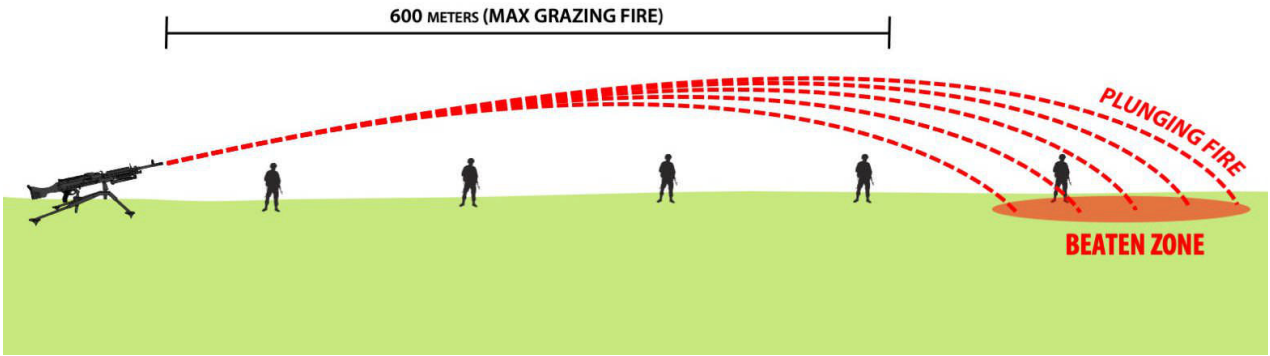
At this point it is important to return to the concept of the machine gun's cone of fire that we discussed earlier. As already explained, if you fire a burst of bullets at a paper target in front of you, the bullets will spread out on the target forming a cone shape from the muzzle of your machine gun. The further away these bullets get from the gun, the wider the cone will be since the bullets continue to spread apart as they fly. With this in mind, consider the diagram below. As you fire a burst, the cone of fire begins to spread as it travels along the arc-shaped trajectory discussed in the last section. Therefore, when the bullets impact the ground they do not impact all at the same point but rather in an oval-shaped area on the ground called the beaten zone.



MACHINE GUN BALLISTICS: PLUNGING FIRE

The Beaten Zone and Plunging Fire

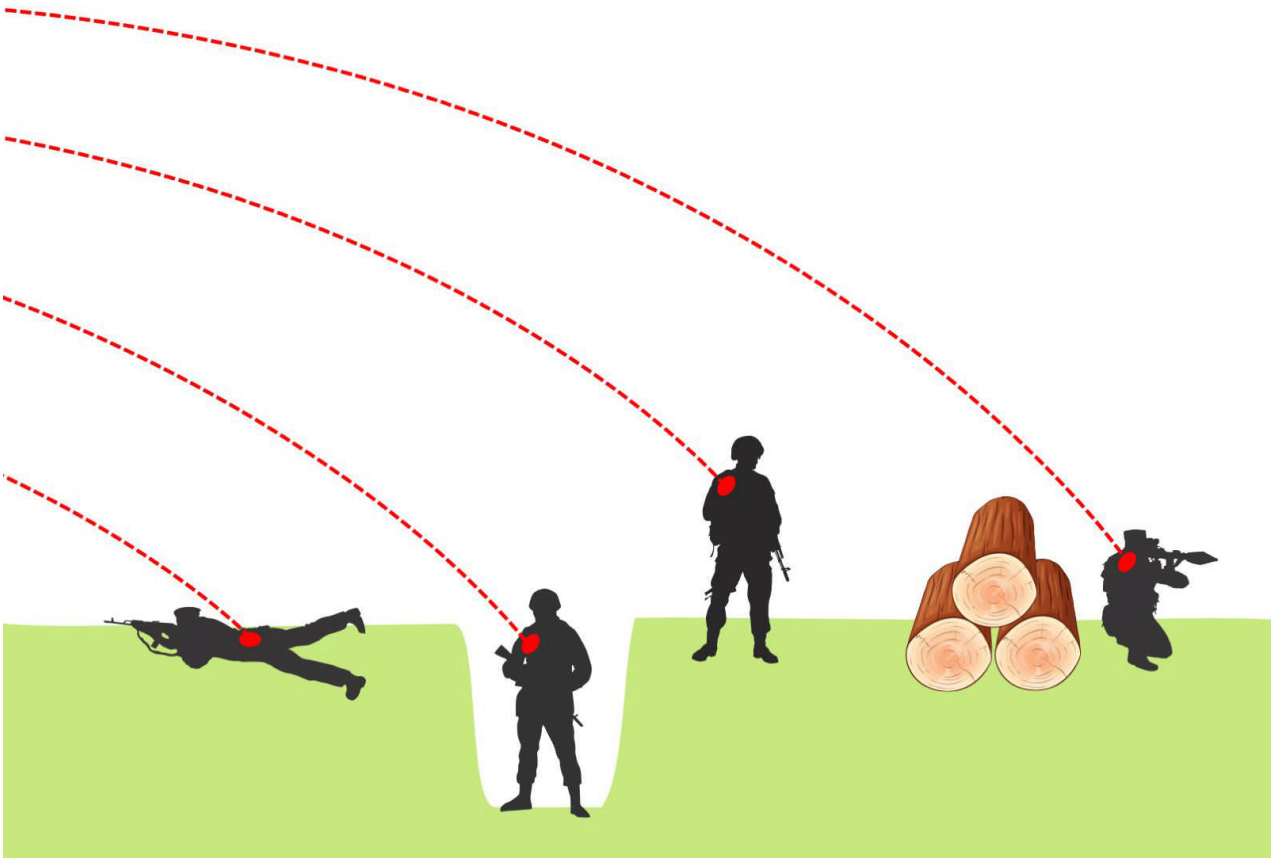
We now return to the diagram we used to discuss grazing fire with the same five enemy troopers spread out at different ranges. If you recall, when employing grazing fire, the same burst of fire could hit any of the four enemy troopers on the left because they were all within 600m. However, we were unable to engage the trooper on the far right with grazing fire because a bullet from an M240B will only travel along the ground for 600m before striking the earth. However, if we point the weapon higher and raise the trajectory of the bullets, the burst will fly farther and be able to hit the enemy trooper on the far right. The bullets will fall on the enemy trooper in a downward angle and that is why we call this type of fire plunging fire. However, note that because we raised the trajectory of the bullets, they will now only be able to hit the enemy on the far right and will pass harmlessly over the heads of the other four enemies to the left. So while grazing fire could have potentially hit any of the four troopers to the left, in this example of plunging fire, only enemy troops standing inside the beaten zone can get hit by the machine gun bullets.



MACHINE GUN BALLISTICS: PLUNGING FIRE

Plunging Fire Against Covered Positions

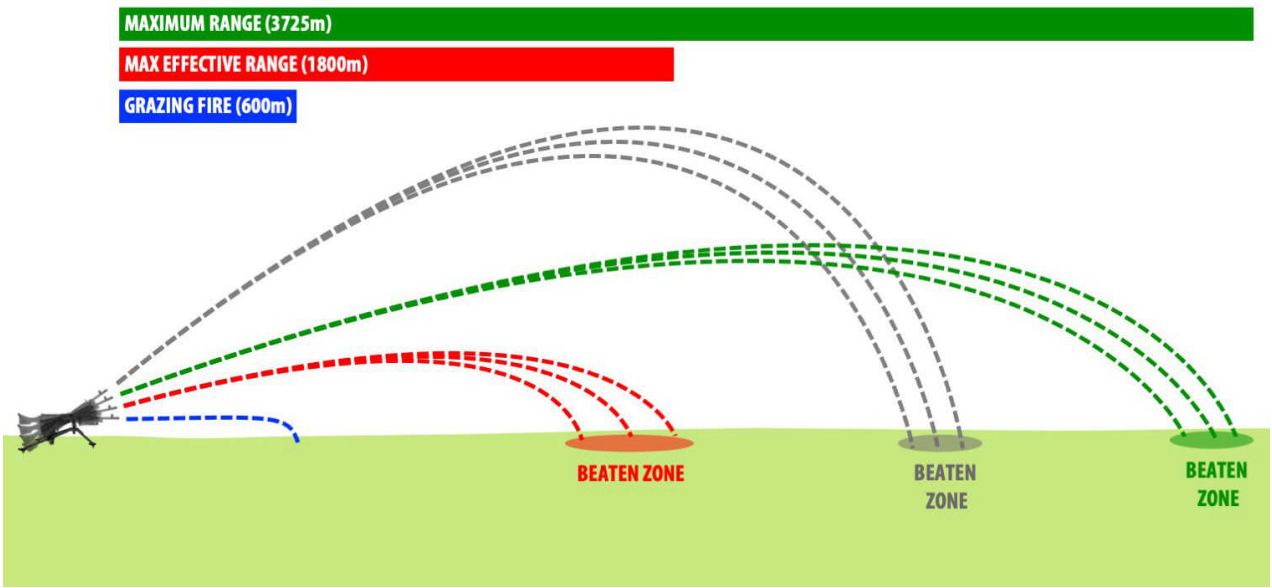
If you recall from earlier, grazing fire (bullets traveling in a flat trajectory along the ground) are likely not to hit enemy troops that are lying prone, dug in or hiding behind cover. As made clear by the diagram below, this is not the case with plunging fire. Because plunging fire falls on enemy positions in a downward trajectory, it has a greater chance of hitting targets that are prone, dug in or hiding behind cover as long as these targets are within the beaten zone. Depending on the exact trajectory of the bullets, the enemy's cover might still prove effective but in general plunging fire presents a greater threat to enemies hiding behind cover.



MACHINE GUN BALLISTICS: TRAJECTORY AND RANGE

Bullet Trajectories and Range

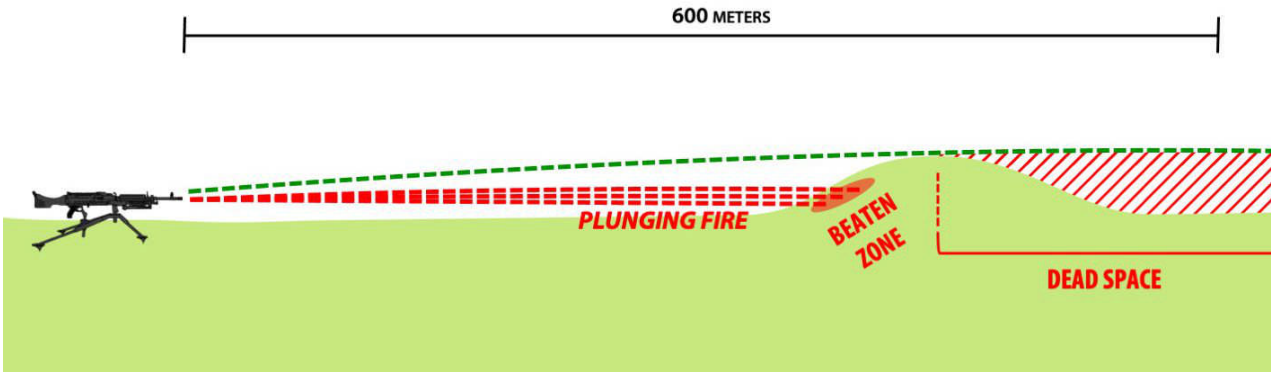
As already discussed, if you fire the machine gun when the barrel is roughly parallel with the ground, the result will be grazing fire (marked in blue) that will travel along the ground out to a range of about 600 meters. If you start to raise the barrel of the gun, the bullets will travel higher and higher along an arc trajectory and your plunging fire (marked in red) will impact the ground in an oval shaped area called the beaten zone. With an M240B, you can effectively move this beaten zone farther and farther out to engage targets up to about 1800 meters away. After this point your fire will likely become less effective. If you continue to raise the barrel after this point the bullets and beaten zone will continue to travel higher and farther away until they reach the maximum range (marked in green) at approximately 3725 meters. The weapon will not be effective at this range but the bullets can still kill/injure people at this range by accident. If you continue to raise the barrel at this point the art of the bullets will still get higher but the beaten zone will start to move back towards your position (example marked in gray). If you fired the gun directly into the air the bullets would travel even higher and eventually fall back down on your position. Understanding the relationship between the height of the bullet's trajectory and the range of the beaten zone is important for knowing how to employ the machine gun effectively.



MACHINE GUN BALLISTICS: PLUNGING FIRE APPLICATIONS

Range and Slope of Terrain

As discussed in the previous sections, a key advantage of plunging fire is that because the bullets actually strike the ground, it is more difficult for enemies to avoid by lying prone or hiding in a foxhole. However, applying plunging fire in a real-world situation can be difficult. In simple terms, it is essentially impossible to employ effective plunging fire at targets closer than 600m. The main exception to this is firing at rising terrain as in the example below. In this example the fire is actually both grazing fire and plunging fire. If the terrain rises, grazing fire will still strike the ground in a beaten zone. For this reason, setting up your machine gun to engage enemies as they descend the face of a hill can offer an advantage. However, if you wanted to use plunging fire to engage enemies hiding behind the hill in the example below, you would have to raise the angle of the barrel towards the vertical mark, sending the bullets very far into the air, allowing them to drop down behind the hill. In most cases this is not practical. Therefore as depicted below, it is generally not possible to engage targets on flat terrain with plunging fire inside of 600m. In some operational environments, like thick forest or jungle, it is very rare to identify or engage targets beyond 600m which means you will generally be limited to employing grazing fire. In mountainous environments with long sight lines like Afghanistan, you will likely employ plunging fire in most situations. It is important to understand these practical applications of grazing fire and plunging fire and how they relate to real-world operational environments and terrain.



MACHINE GUN FUNDAMENTALS
Rates of Fire

There are certain fundamental concepts, sometimes referred to as "machine gun theory" that relate to machine gun employment in almost all types of operations. One of the simplest and most important of these concepts is the machine gun's rate of fire. Rate of fire is critical for three principal reasons: planning/tracking ammunition expenditure, timing barrel changes and the proper functioning of the weapon.

Rate of Fire and Ammunition Expenditure

The amount of weight troopers have to carry for a given mission has a critical impact on combat effectiveness. In modern warfare, loads tend to be heavy because weapons and ammunition are heavy. Most Western nations require troops to wear body armor which adds significant weight to the overall load. If a mission calls for units to remain in the field for several days, the required water, food and other equipment generally requires carrying a large rucksack and will often bring the trooper's load past the 100-pound mark. In some cases, the load will be well beyond 100-pounds. In other cases, excessive loads will end up making missions infeasible, overwhelm smaller troops, or encourage leaders to cut the load amount by making dangerous tradeoffs.

Probably the most critical conclusion to draw from the points above is that ammunition is almost always in short supply in real combat operations. The degree of this shortage depends on the nature of the mission. If there are vehicles available or the mission will only last a few hours, troopers can afford to carry more ammunition. However, if troops must remain in the field for an extended period on foot, the amount of ammunition they can carry will drop significantly because of the competing need to carry water and other needed equipment.

It is also important to remember that even if a mission is expected to be short, if things go wrong, troops can end up stuck in the field much longer than expected. In addition, relying on vehicles to transport ammunition and equipment, or relying on frequent resupply can also lead to unexpected setbacks. What if the vehicle carrying most of the ammunition is destroyed?

What if the resupply convoy is attacked and never makes it to its destination? These contingencies make ammunition conservation important for every operation, even those where ammunition is not thought to be in short supply.

Trends in U.S. military training do not always encourage the right mentality when it comes to ammunition conservation. Many military schools and unit training events use blank ammunition as a training aid. This allows troops to carry, load and fire actual bullets that make a semi-realistic popping sound when fired. This adds to the realism of training by requiring troops employ their weapons in a similar way as they might in combat, performing tasks like reloading, clearing malfunctions, and cleaning out carbon buildup between engagements etc.

However, these schoolhouses often do not use other training equipment (such as laser force-on-force systems) to identify when fired rounds actually strike their targets. There are sometimes justifiable reasons for not using laser training aids, such as logistical challenges or lack of overall realism of the systems, but either way the end result is that while troopers get to practice operating their weapons, there is no incentive for them to actually practice aiming when they fire. Troopers end up 'simulating' engagements by firing haphazardly while not moving or thinking the way they would in an actual firefight. This training environment and mindset does not emphasize fire discipline and ammunition conservation.

To make matters worse, many training schools aim to place troops under stress by forcing them to carry heavy loads for extended periods of time with minimal food and sleep. This often leads troopers to cut corners and do whatever they can to make things easier. Since ammunition is often one of the heaviest components of a trooper's load, when simulated combat engagements do occur, the primary goal is once again not taking aimed shots (since there is no way to track hits anyway) but rather to fire off as many rounds as possible since firing off several hundred rounds in an engagement significantly reduces weight on the shoulders, at least until the next resupply.

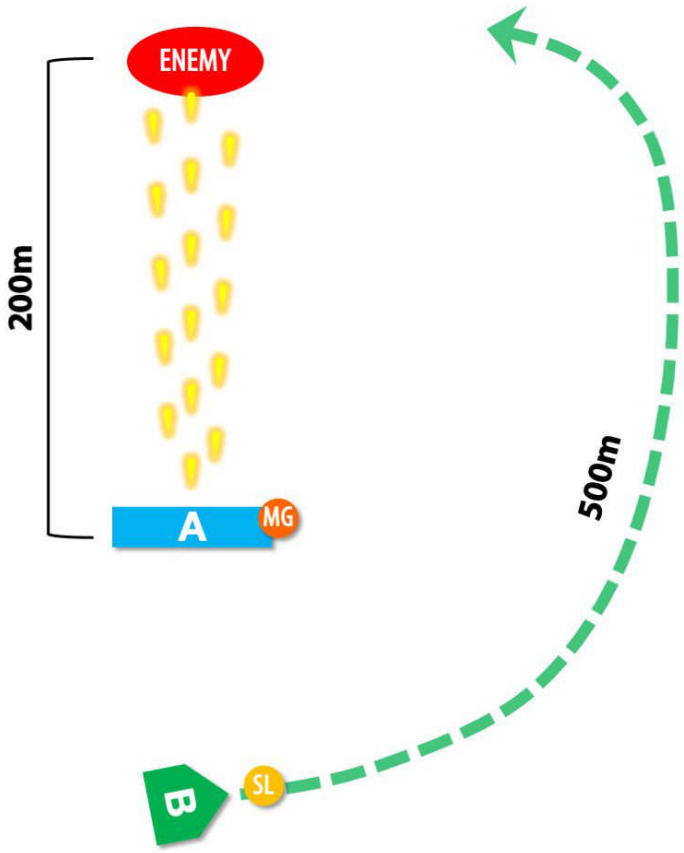
Finally, schoolhouses and training events very rarely involve extended engagements or firefights. Part of this comes from the fact that accurately simulating a prolonged firefight is difficult. A second component is the need to make training efficient and manageable. Spending hours bogged down in one engagement prevents the unit from moving on to other iterations or training activities. However, in real warfare, prolonged engagements that last many hours are not uncommon. While ammunition conservation is not important in a training engagement that lasts only a few minutes, it becomes much more concerning in a life-and-death fight that lasts hours or even days.

For all these reasons, the critical considerations of ammunition conservation are often overlooked in modern military training activities which in turn leads machine gunners to overlook the need to carefully control their rates of fire. One of the three main reasons why rates of fire are important is because they make the expenditure of ammunition more predictable and quantifiable. This in turn allows leaders to make more effective plans for how to expend and conserve ammunition and allows them to monitor ammunition expenditure more accurately while engaged in combat. The diagram and discussion on the next page provides an example of how a single engagement, executed according to common tactical doctrine can end up almost entirely depleting a small unit's ammunition supply.

EXAMPLE: AMMUNITION EXPENDITURE WHILE FLANKING

Engagement Distance and Ammo Load

A typical engagement range in conventional warfare could be as far as 200m or 300m. This means if the flanking element makes even a moderately bold flank (as shown in the picture, the total movement distance for the flanking element will likely be farther than 500m. Moving 500m over rough terrain in full gear, especially at night can take time. Then consider that if the machine guns in the support position are firing at a sustained rate of fire (100 rounds-per-minute), based on standard U.S. Army basic ammo loadouts, the light machine guns will have probably expended their ammunition and the medium machine guns will be at least half-empty by the time the assault element is in position to assault. These figures cannot be exact since many variables come into play including adjustments to the basic load, ammunition that was already expended earlier and movement speed of the flanking element. However, the general lesson from this example is that a single combat maneuver can end up depleting or nearly depleting a squad's ammunition.



Given this example, the next logical question to consider is what happens when a unit must face another engagement before having the chance to resupply? If a single engagement can nearly deplete a small unit's ammunition, that unit will almost certainly run out of ammunition in a second engagement. It is also important to consider that when planning for operations and trying to maintain combat effectiveness, being completely out of ammunition should only be possible in the most extreme of circumstances.

A unit will always want to maintain at least a small reserve of ammunition to protect itself until it can resupply. Therefore, ammo conservation planning and considerations should factor in this reserve supply. This places further constraints on ammo expenditure and makes rates of fire even more important.

Rates of fire allow leaders to make plans and quick mental calculations about ammunition expenditure. For example, the sustained rate of fire for an M240B medium machine gun is 100-rounds-per minute. This means that leaders can perform a simple mental calculation to determine ammunition expenditure at a given rate of fire depending on the length of time the gun will be firing for example, to determine how many rounds a gun will fire in five minutes, a leader will perform the following calculation…

This is of course a very simple example and calculations can get more complicated when factoring in different rates of fire and multiple guns. However, the general equation remains the same. The rate of fire in rounds-per-minute, multiplied by the length of firing time equals the total amount of rounds expended.

If machine gunners do not practice employing specific rates of fire, there is no way for leaders to make the type of planning calculations just discussed. If a leader plans an attack or maneuver based on a machine gun firing 100 rounds-per-minute but the gun team unknowingly fires at 150 rounds-per-minute, the discrepancy might cause problems. When gun teams with limited combat experience are under extreme stress, the likelihood of straying from prescribed rates of fire increases dramatically. For this reason, it is important for all gunners to clearly understand rates of fire and emphasize rates of fire in every training event and combat engagement. We will discuss the specifics for how to do this in more detail later in this section.

Rate of Fire and Barrel Changes

Civilians whose only experience with machine guns comes from action movies often do not know that if you continuously fire a machine gun for too long it will overheat and ultimately the barrel will actually melt. Unfortunately, civilians are sometimes not the only ones who prove ignorant of this important fact. Machine gunners who are less experienced will often forget that

their weapon does not operate the way machine guns do in the movies. These mistakes are even more common when the gunner is under extreme stress. Therefore, just as it is important for every gunner to fully understand the concepts of ammunition conservation and apply those concepts to training, it is equally important that every gunner understand the capabilities of his/her weapon and understand how and when to conduct barrel changes to prevent the gun from overheating.

Like rates of fire, barrel change times are particular to each specific weapon system. However, barrel change times also depend on the specific weapon system's rate of fire. For example the M240B medium machine gun does not have on specific time interval for barrel changes. Rather, if the gun is firing at sustained rate of fire (100 rounds-per-minute) you should plan to change the barrel after no more than 10-minutes of continuous fire. However, if the gun is firing at rapid rate of fire (200 rounds-per-minute) you should plan to change the barrel after only 2-minutes of continuous fire.

Therefore, as is the case with ammunition conservation, the need to change barrels to prevent overheating places additional emphasis on the importance of rates of fire. If a gunner is not firing at prescribed rates of fire, it can be more difficult to determine when to conduct a barrel change. This can lead to an increased chance that the gun will overheat or malfunction, especially in a high-stress situation. Later in this section we will discuss more specifics on how to execute barrel changes and factor them into mission planning and combat execution based on predetermined rates of fire.

Rate of Fire and Weapon Function

A third reason why rates of fire are important is because weapons will function better, malfunction less frequently and require less maintenance when they are fired at certain rates. There is often no magic number when deciding on the ideal rate of fire for a particular weapon. While field manuals and technical manuals provide some level of consistency, real-world experience often leads to theories that firing at slightly different rates will improve performance.

In reality, weapon function is a very complex and scientific subject that is influenced by many different technical and environmental factors. To truly understand and optimize weapon functioning requires extensive knowledge, skill and an intuitive sense that only comes from years of employing machine guns in realistic conditions. As mentioned in the introduction, this book is not intended as a technical manual or armorer's manual and will therefore stick to the rates of fire suggested by doctrine in most cases. However, it is important to know that these values are not set in stone and you may want to adjust them based on the advice of the more experienced gunners in your unit.

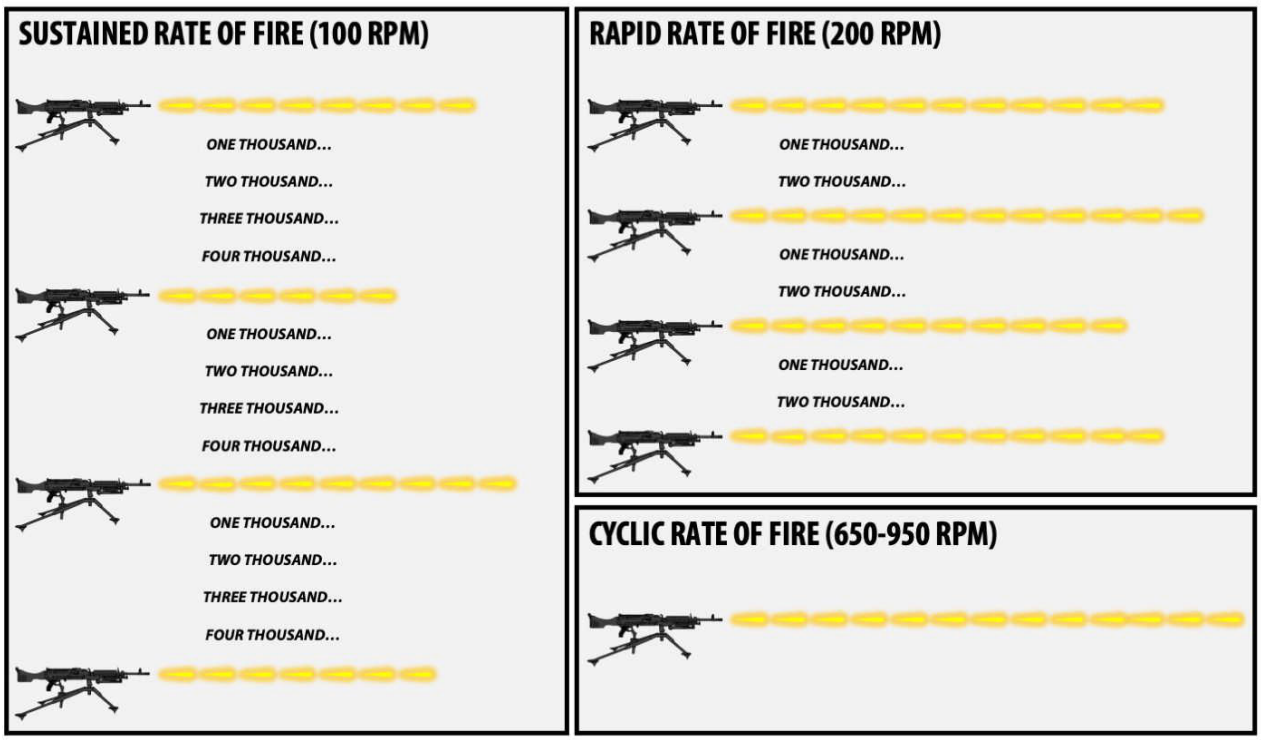
The important point to keep in mind is that rate of fire does have an impact on proper weapon function. This is another reason why firing machine guns at a specific rate of fire is critical for combat effectiveness. If a machine gun goes down in the middle of a fight because of a malfunction or maintenance issues, the result could be catastrophic defeat or increased friendly casualties.

RATE OF FIRE EXAMPLE: MEDIUM MACHINE GUN

M240B Medium Machine Gun Rates of Fire

Looking at the example below, to fire an M240B at a sustained rate of fire you should fire a 6-9 round burst every 4-5 seconds. This requires getting used to what a 6-9 round burst sounds like and practicing with real bullets. You should also ensure you are able to count off seconds with reasonable accuracy. Putting it all together, you fire your burst, then count, then fire your next burst and keep repeating that process. Rapid rate of fire calls for a slightly longer burst with a shorter pause in between. You must practice firing at both sustained and rapid rates of fire until it becomes second nature. To fire at a cyclic rate of fire you simply hold down the trigger in a continuous burst. You must also start a timer when you begin firing to ensure you change the barrel before it overheats. If you fire a combination of different rates of fire, use your best mental math to approximate when to change the barrel. The image below the table gives a graphic depiction of different rates of fire for the M240B. Different weapons have different rates of fire so you must study your individual weapon and practice accordingly.

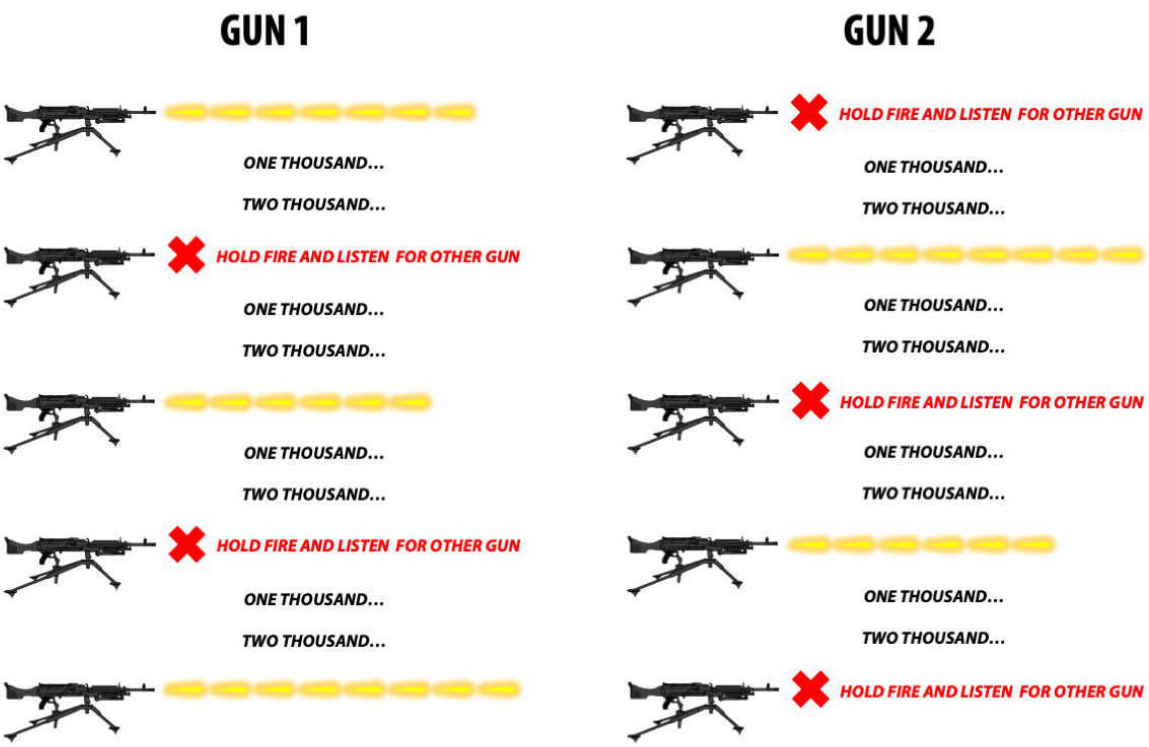
RATE OF FIRE	ROUNDS/MINUTE	BURST vs. PAUSE	BARREL CHANGE
Sustained	100	6-9 round burst every 4-5 sec	10 min
Rapid	200	10-12 round burst every 2-3 sec	2 min
Cyclic	650-950	Hold down trigger	1 min



TALKING GUNS TECHNIQUE

Pair of M240B Medium Machine Guns

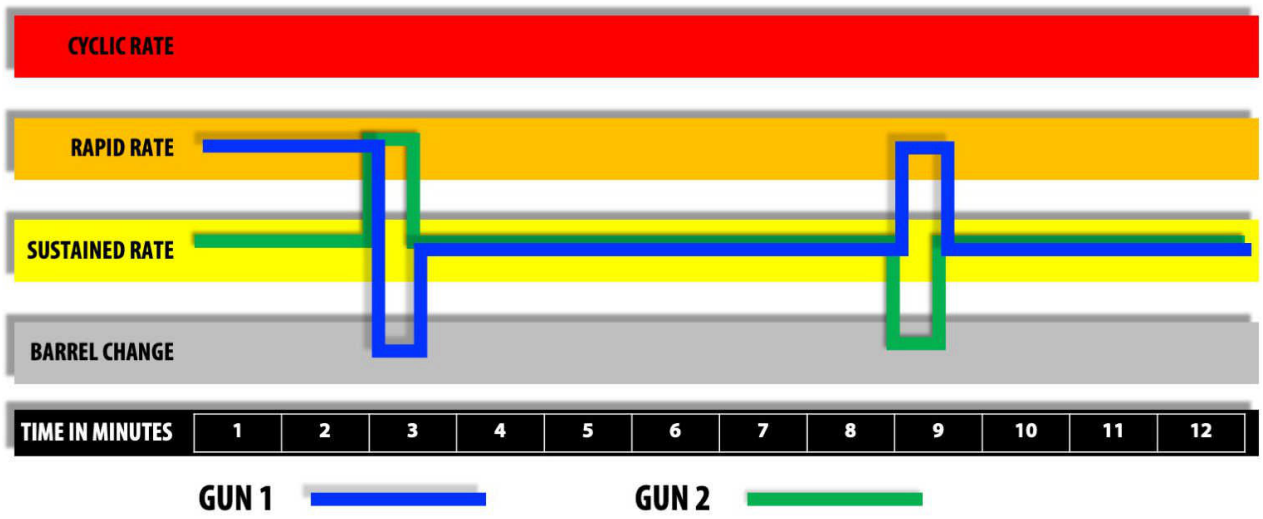
Whenever you are employing more than one gun, you should generally use the "talking guns technique" since it provides a number of advantages. Talking guns means that one gun team fires a burst, then listens for the other gun to fire burst, then "answers" back with another burst and so on. Two talking guns, each firing at a sustained rate of fire achieve roughly the same volume of fire as a single gun firing at a rapid rate. If two talking guns each fire at a rapid rate of fire they achieve close to the same volume of fire as a single gun firing at a cyclic rate. One of the main advantages of employing talking guns is that if one gun goes down, the other gun will immediately know because it will fail to hear a response to its last burst. The second gun can then increase the rate of fire to provide cover for the other gun until it gets back into the fight. Below is an example of two talking guns each firing at a sustained rate of fire.



TALKING GUNS AND BARREL CHANGES

Techniques to Offset Barrel Change

If you have multiple guns all firing at the same rate of fire that will mean that all guns will have to change barrels at the same time. This will mean all suppressive fire will stop at once which will likely cause serious problems for your forces, especially if your maneuver element is nearing the assault position. Therefore, it is important to establish some unit standard operating procedures (SOPs) for offsetting your barrel changes. There are many ways to do this but the most important thing is to practice and experiment in training to find the techniques that work best for you. In the example below, gun 1 (in blue) fires for the first two minutes at a rapid rate of fire and then changes barrels, setting up the offset pattern. Note that while gun 1 is changing barrels, gun 2 (in green) increases to rapid rate of fire to cover gun 1. Gun 2 also changes barrels at the 8-minute mark instead of the 10-minute mark to further increase the offset between barrel changes. Once again, this is just an example and you can develop your own SOPs to make sure two guns are not changing barrels at the same time.



MACHINE GUN EMPLOYMENT
Tactical Concepts

The following section provides some core concepts that are fundamental to effective machine gun employment. These are not necessarily real-world examples but rather general principles that can apply in many situations. When you understand these tactical concepts and principles, they will form building blocks that you can combine to solve various tactical problems and gain an advantage in a fight.

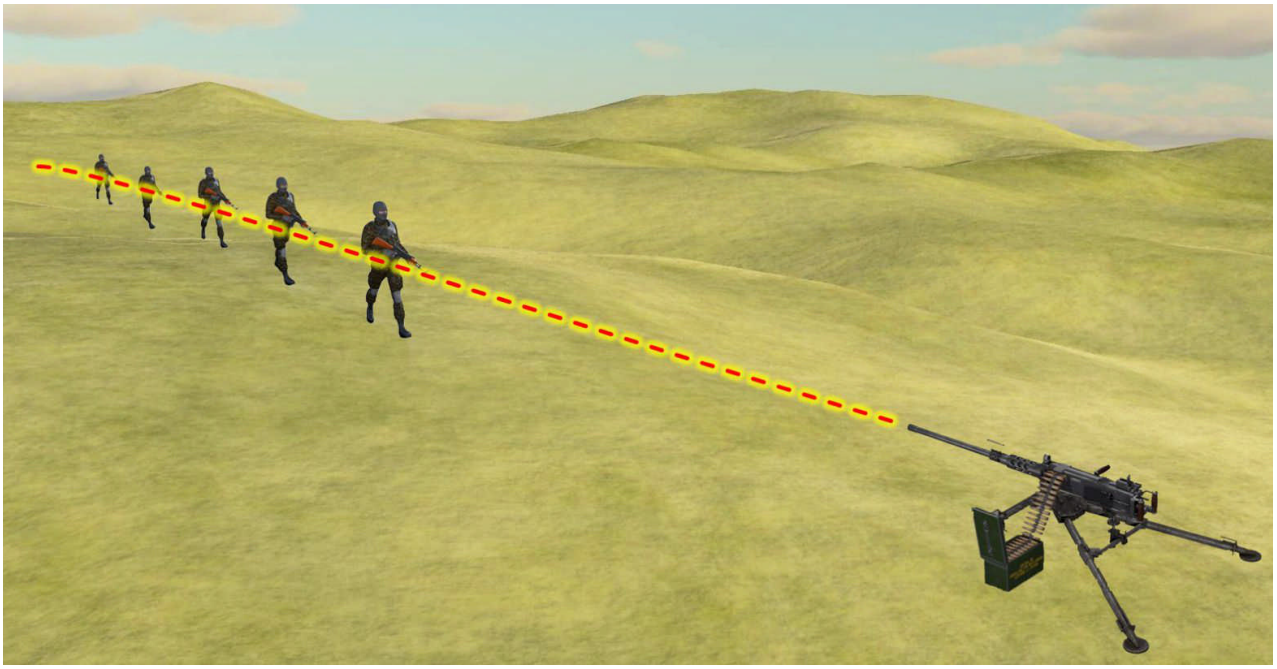
While there are many concepts and principles that apply to every level of warfare, the following principles primarily deal with what makes machine guns effective and how to take maximum advantage of the machine gun's strengths. It is possible to use a machine gun like a regular assault rifle. It is even possible to attempt to use a machine gun for close quarters urban combat. However, in these cases you would not be taking advantage of the machine gun's strengths. The following tactical concepts offer ways to leverage your machine guns' strengths against enemy weaknesses and take maximum advantage of the firepower potential you have in your machine guns.

These tactical concepts build off the previous discussion of machine gun theory. Without an understanding of how machine guns work and engage targets, many of the following sections would be difficult to understand. In turn, this section is critical to the following sections on techniques of machine gun employment and machine gun battlecraft. Each section builds upon the last, leading to an enhanced capability for employing machine guns in a real-world combat engagement.

TACTICAL CONCEPTS: ENFILADE FIRE

Grazing Fire or Beaten Zone Along Formation's Long Axis

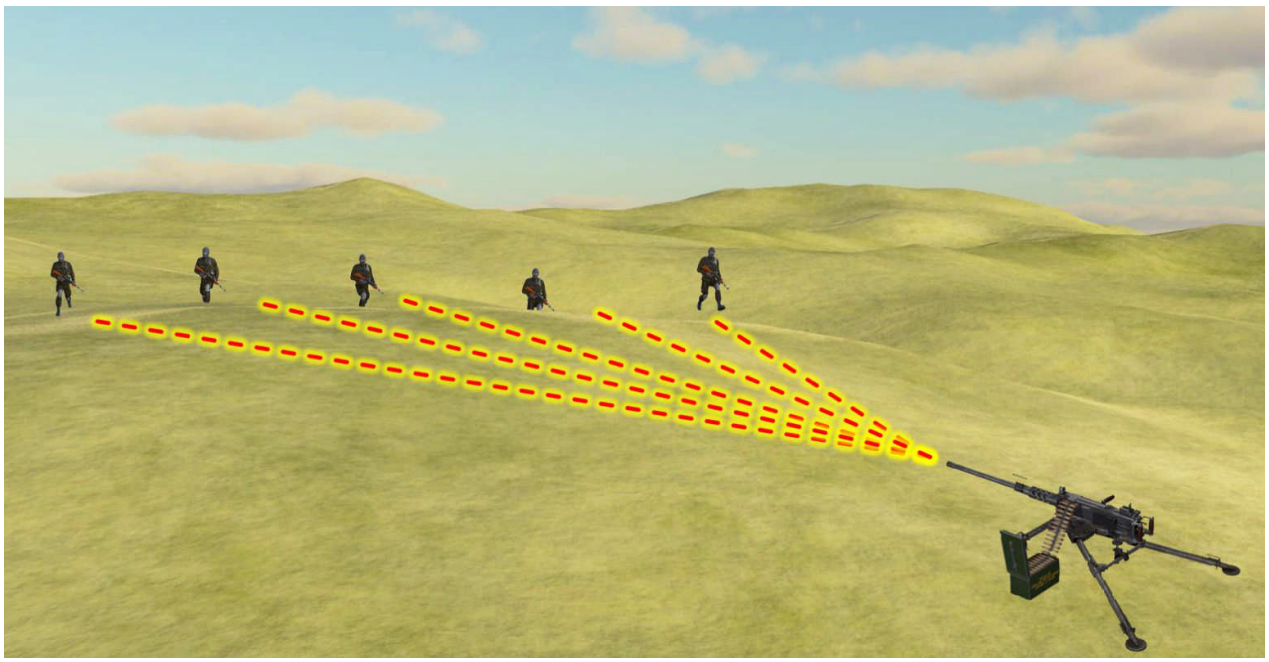
Enfilade fire is when the trajectory of fire (grazing fire or the beaten zone) is aligned and parallel with the long axis of the enemy formation. This is the most lethal orientation of fire as it relates to the enemy's formation. This is because as a bullet passes through the formation, it will have a greater chance of hitting someone if the entire element is in a line. A single bullet can also pass through two people. Enfilade fire also makes the shooter's job easier since he/she can target the entire formation without having to traverse the weapon to the left or right. The image below shows an example of enfilade fire.



TACTICAL CONCEPTS: ENFILADE FIRE

The Opposite of Enfilade Fire

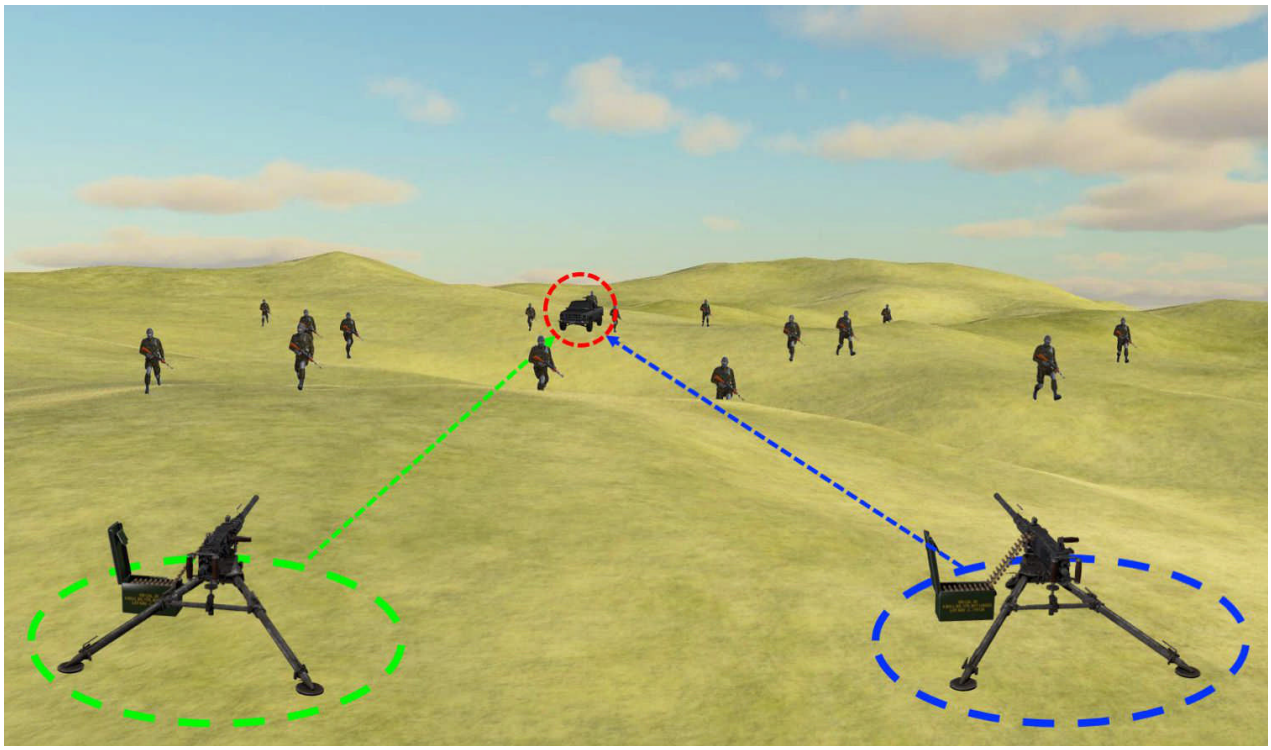
While more linear formations are particularly vulnerable to enfilade fire that passes through their long axis, they are less vulnerable to fire that is perpendicular to the long axis for several reasons. The illustration below gives an example of this. Each incoming bullet has less chances of hitting and if it does hit someone, it will pass through the formation and not hit anyone else. It is also more difficult for the gun to engage multiple targets since it will have to traverse left and right to engage each target. For this reason, machine guns should always try to achieve enfilade fire on the enemy formation.



TACTICAL CONCEPTS: CONCENTRATION OF FIRE

Mass Fire on the Most Critical Targets

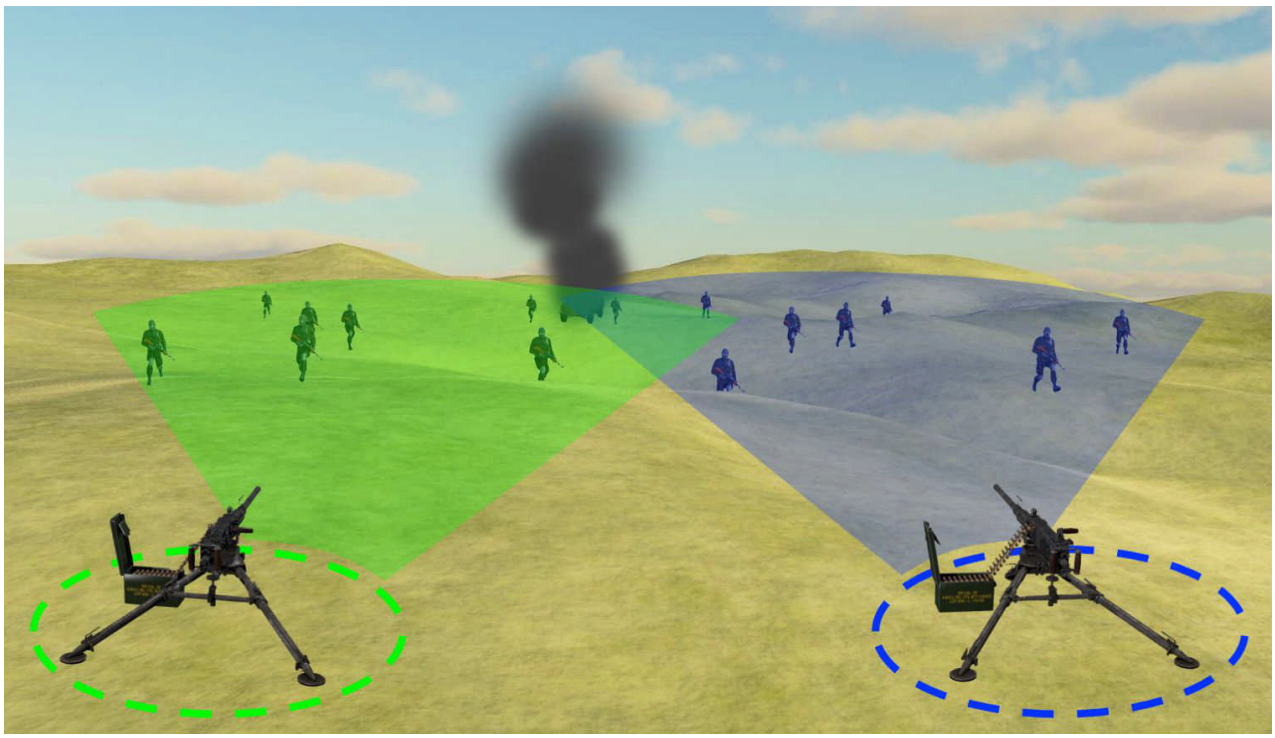
Some tactical situations call for massing or concentration of fire on a single, critical target. In the illustration below, two guns are engaging advancing enemy forces comprised of dismounted infantry and a heavy machine gun mounted on a technical vehicle. In this case the leader might decide the heavy machine gun on the vehicle is the highest priority target and will order both guns to focus fire on the enemy vehicle first to take it out of the fight immediately. Eliminating the enemy's decisive weapon system will tip the scales of the engagement early and give you an advantage for the rest of the engagement. This is just one example of when you might want to mass fires on a particular target. You may need to mass fire on an armored vehicle to destroy that vehicle, or mass fire on a fortified position to slowly degrade the value of the cover it provides. In all of these cases, machine guns are most effective when you concentrate their effects to mass fire on the enemy. If machine gun fire is dispersed or random in these cases, you might not mass enough fire to achieve the desired outcome.



TACTICAL CONCEPTS: DISTRIBUTION OF FIRE

Sectors of Fire and Avoiding Target Overkill

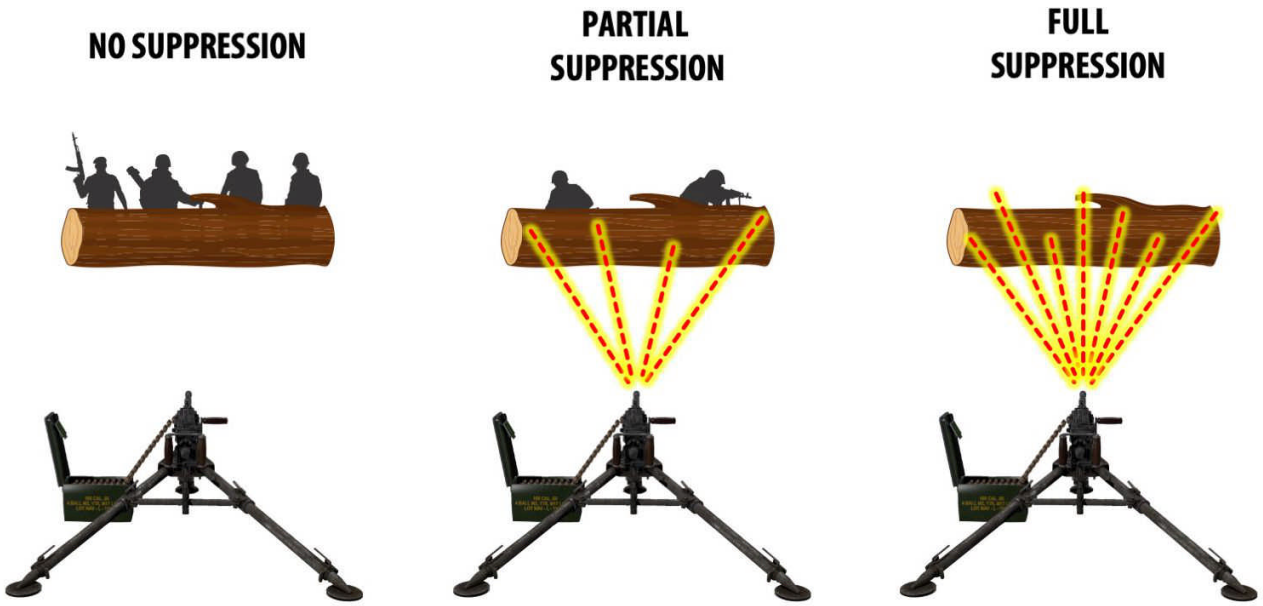
While the previous examples explained situations when it was ideal to mass all or most of the available guns on a single target or area, there are other cases when it is important to do the exact opposite and distribute fires more evenly across a wider area. Consider the example below. If you already massed fires on the technical vehicle and destroyed it, you do not want to continue wasting time and ammunition firing on the same target while enemy infantry advances on your position. You need to spread out your fire to engage the infantry. However, in this case, with many potential targets of roughly equal value, you do not want to focus all your fire on one enemy trooper or one specific area. Doing so would mean leaving the other targets unengaged and free to move forward. In the example below one gun (labeled in green) focuses on targets on the left side while the other gun focuses on targets to the right side. This helps the guns to engage all targets more quickly while avoiding wasting time and ammunition overkilling a single target.



TACTICAL CONCEPTS: VOLUME OF FIRE

Rates of Fire and Multiple Guns

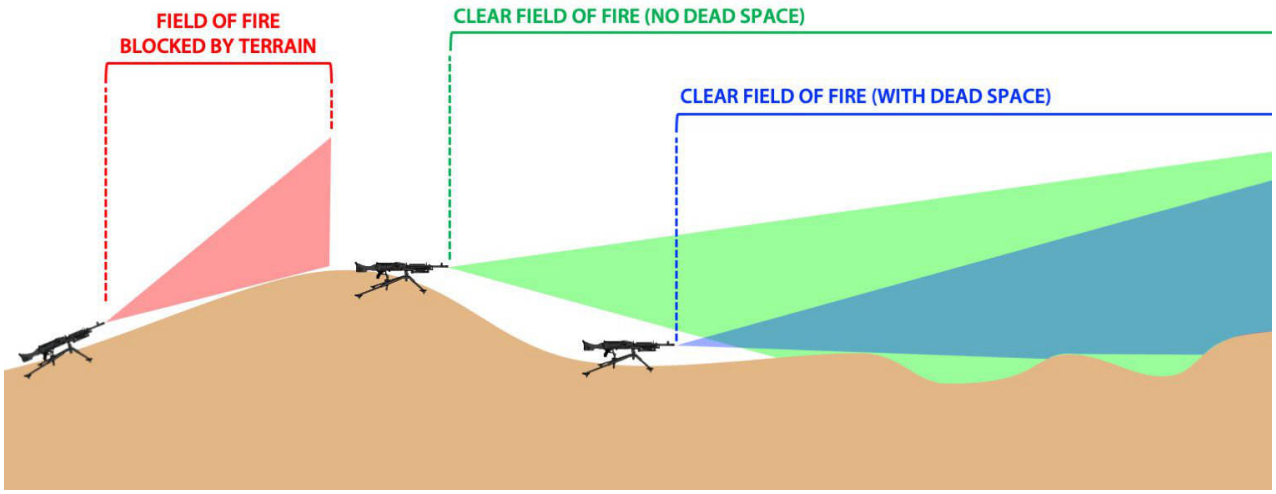
A concept that is related to massing of fire is the volume of fire. The volume of fire on a given target must be sufficient to achieve your desired outcome. If your aim is to suppress an enemy position, you need to deliver enough effective fire on that position to actually make the enemy troops take cover and keep their heads down. In the example on the left, if you are not firing at an enemy position at all, the enemy will be free to stand up, move and shoot back as needed. In the middle example you have laid some fire down on the enemy position. Some of the troops are hiding behind the log and the others are hunkered down or returning fire. You have achieved some suppression but still not the adequate volume of fire needed for full suppression of the enemy position. In the example on the right you have enough volume of fire to achieve full suppression. In general, there are two ways to increase volume of fire. First, you can increase the rate of fire. Firing at a rapid rate of fire (200 rounds-per-minute for an M240) produces twice the volume of fire as sustained rate of fire (100 rounds-per-minute). If increasing rate of fire is not possible or not sufficient, the second option is to add more guns to the equation. In simple terms, two guns will produce twice the volume of fire as one gun. It is also important to remember that the accuracy and placement of your fire has an impact on its effectiveness as well.



TACTICAL CONCEPTS: FIELDS OF FIRE

Position to Take Advantage of the Gun's Capabilities

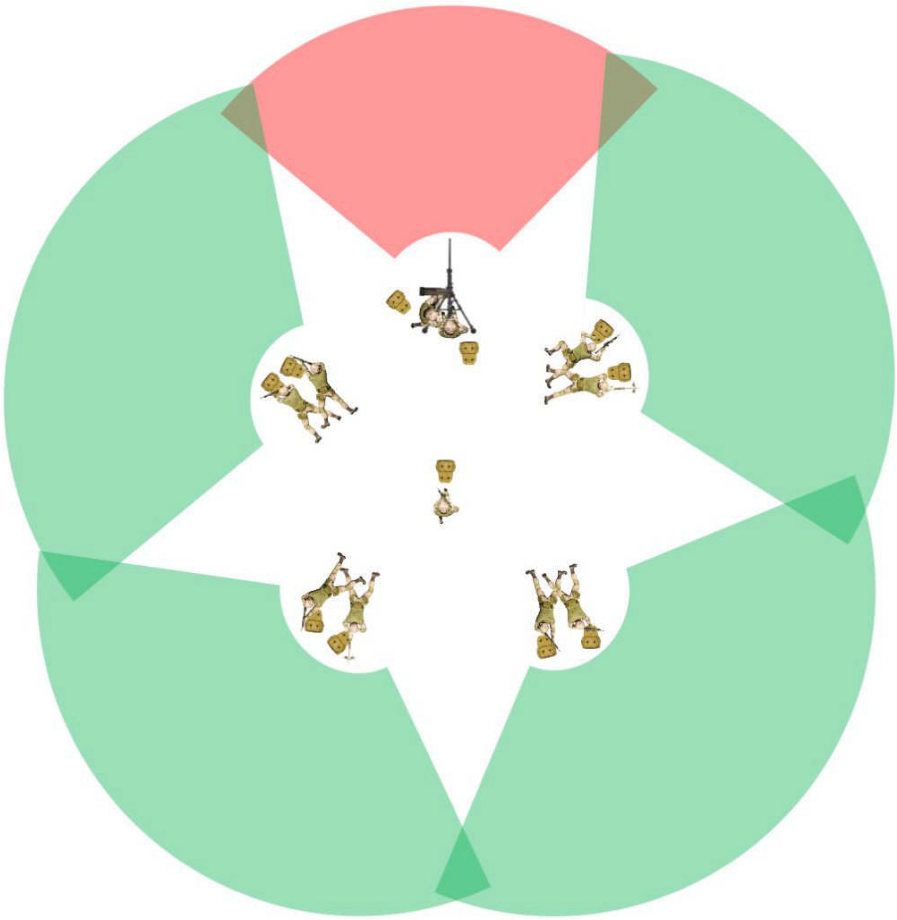
Positioning guns to maximum advantage is another critical tactical concept. You can have an excellent gun team that understands how to mass fire and distribute fire effectively but if the gun is in the wrong place it will be of little help to your tactical situation. Proper positioning often means ensuring the gun as a clear field of fire out to an acceptable range. Machine guns have an advantage over regular assault rifles in their ability to engage area targets at long range. Therefore, if your machine gun team can only see 20-meters to the front, you are not taking full advantage of your weapon systems. In the example below, the gun marked in red can only see and shoot a limited distance because terrain block's the guns field of fire to the front. The gun marked in blue has a clear field of fire and can shoot farther out towards the gun's maximum effective range of 1800-meters. However, the gun is still not optimally positioned because there are dips in the ground (dead space) that the gun cannot see or engage. Therefore, you are still not taking maximum advantage of your gun. The gun marked in green as a clear field of fire but can also see into the dead space due to its elevated position. In the example below the gun marked in green is positioned to take maximum advantage of its capabilities.



TACTICAL CONCEPTS: FIELDS OF FIRE

Orient Guns Towards the Greatest Threat

Another component of proper gun positioning is ensuring the gun is ideally placed within the formation. In most cases, this simply means keeping the gun near the outside of the formation and orienting it towards the direction of greatest threat. If you position the gun in the center of your formation it will not be able to fire outward without risking hitting your own troops. Therefore, it is generally best to keep the gun near the edge of the formation. There can be exceptions to this in cases when you want to keep the gun protected, in reserve and ready to deploy in any direction. The second important point is to place the gun oriented towards the greatest potential threat. When patrolling, this is often to the front of the formation (as in the example marked in red below) but this can change based on the terrain and situation. If you are breaking contact or moving away from enemy forces, the greatest threat will likely be to the rear. Finally, as demonstrated below, it is always important to ensure fields of fire are overlapping. This will prevent gaps in your security or suppression that the enemy might use to his advantage.



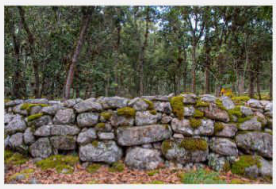
TACTICAL CONCEPTS: COVER AND CONCEALMENT

Protect Your Guns from Enemy Fire

While it is important to ensure your guns have clear fields of fire and placed in the best location within the formation, you must also ensure your guns are protected. This means ensuring your guns have adequate cover and concealment. Cover provides protection from enemy bullets while concealment only protects you from enemy observation. Therefore, when protecting your guns, finding good cover is the highest priority. The examples in green below all provide good cover, meaning they can stop enemy bullets. The examples in red might provide concealment but will not protect you from enemy bullets. Therefore, you should not position your machine gun behind a bush and expect the bush to protect against enemy fire. It is also important to note the relationship between cover and fields of fire. It can be difficult finding a position that provides both good cover and good fields of fire. Positions that offer better fields of fire are often more exposed and offer less cover and protection. Do your best to find the position that offers the best balance of cover and field of fire based on the situation and your mission.

GOOD COVER

THICK TREES



STONE AND ROCK

DUG IN POSITIONS

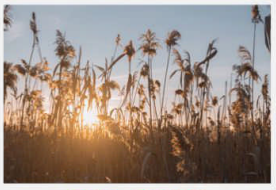
TERRAIN AND EARTH

POOR COVER

THIN TREES

DEAD WOOD

PLANTS AND BUSHES

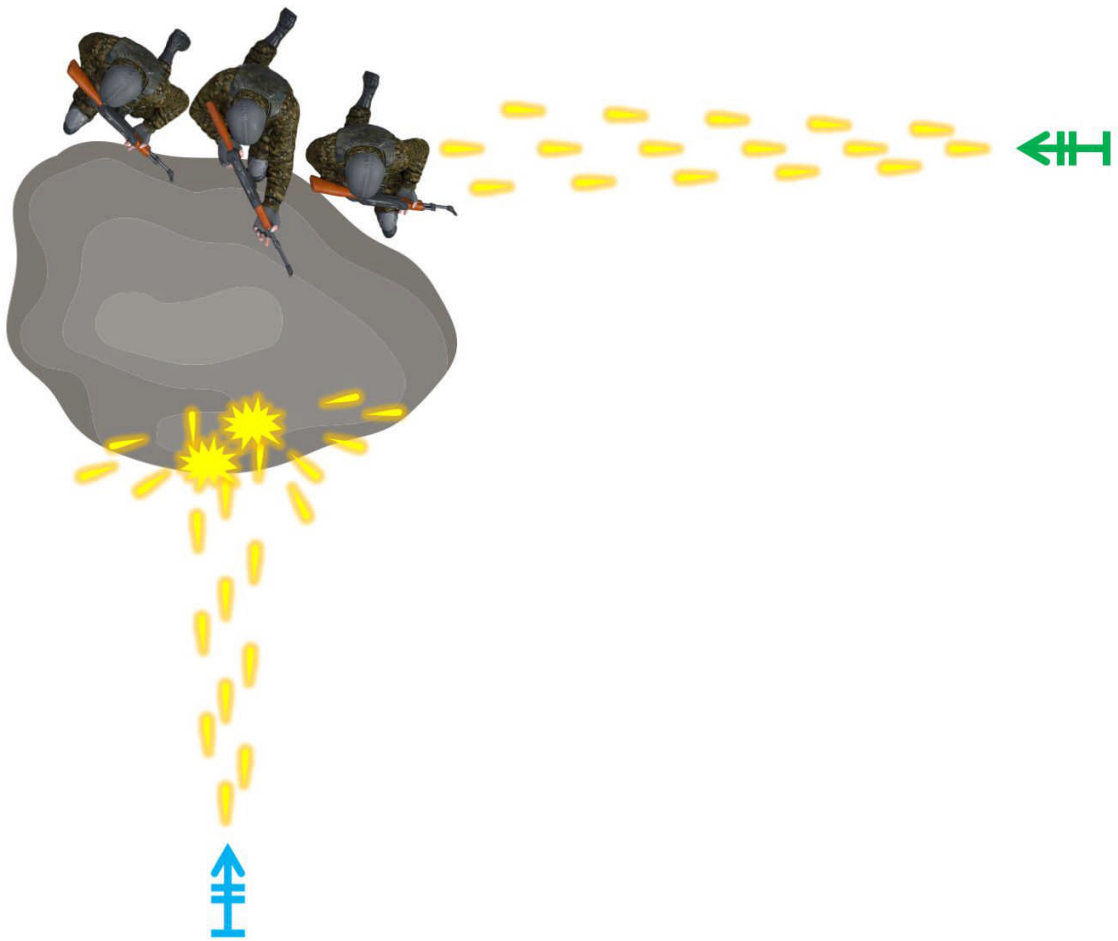


TALL GRASS

TACTICAL CONCEPTS: ANGLES OF FIRE

Widening the Angle Between Guns and the "Tactical-L"

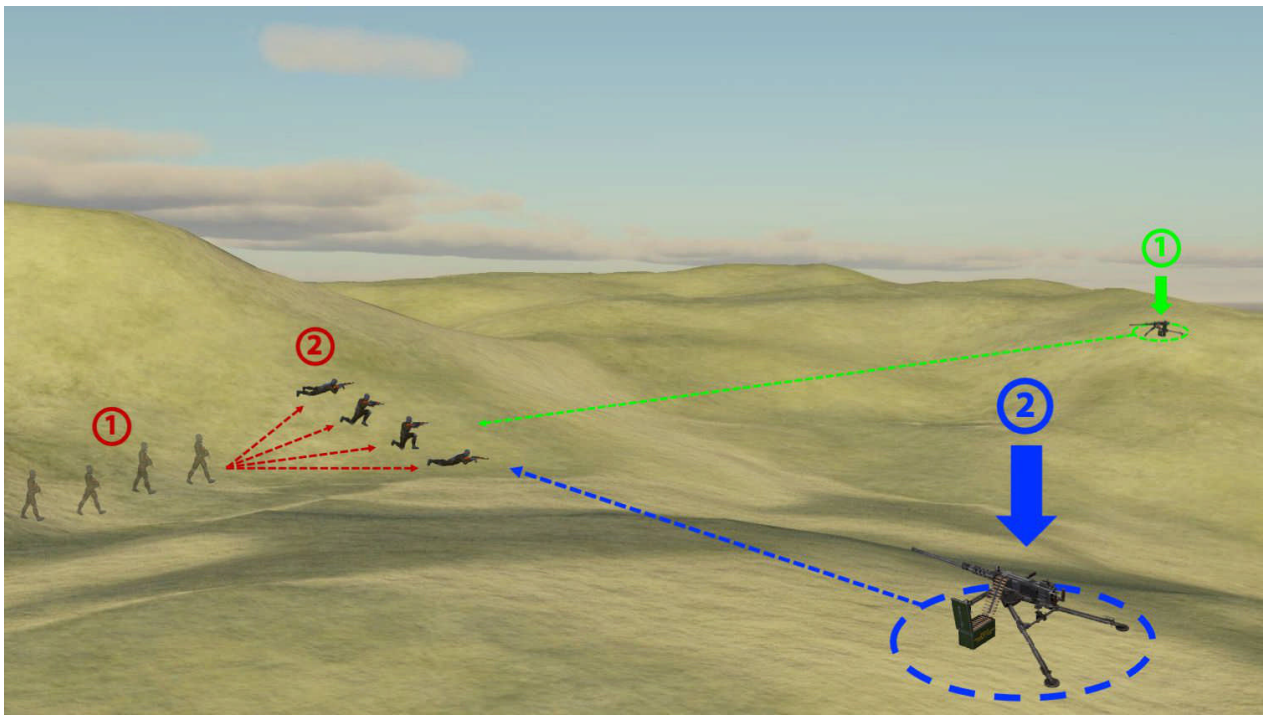
The term tactical-L describes a situation where the enemy is taking fire from two perpendicular (90-degree) directions. This makes it difficult for the enemy to take cover since taking cover from one direction of fire will generally expose him to the other direction of fire. In the example below, you have two guns firing from a tactical-L on three enemy troops taking cover behind a large boulder. The boulder is protecting them from fire to their front (from the gun marked in blue) but the fire coming in from the flank (the gun marked in green) is about to cut down their formation. If the enemy troops repositioned to take cover from the green gun, the blue gun would then have a clear field of fire. Therefore, achieving a tactical-L with your fire makes it difficult for the enemy to take cover. Even if the enemy is dug in, with protection from every angle, the tactical-L still offers an advantage since the enemy will have to distribute their return fire in two different directions. It is also important to note that it is not critical to achieve a perfect "L" or precise 90-degree angle for the concept of the tactical-L to prove effective. If you widen the angle between your guns, even slightly, you are taking advantage of the tactical-L concept.



TACTICAL CONCEPTS: SEQUENTIAL FIRE

Using Sequential Fire to Force a Predictable Reaction

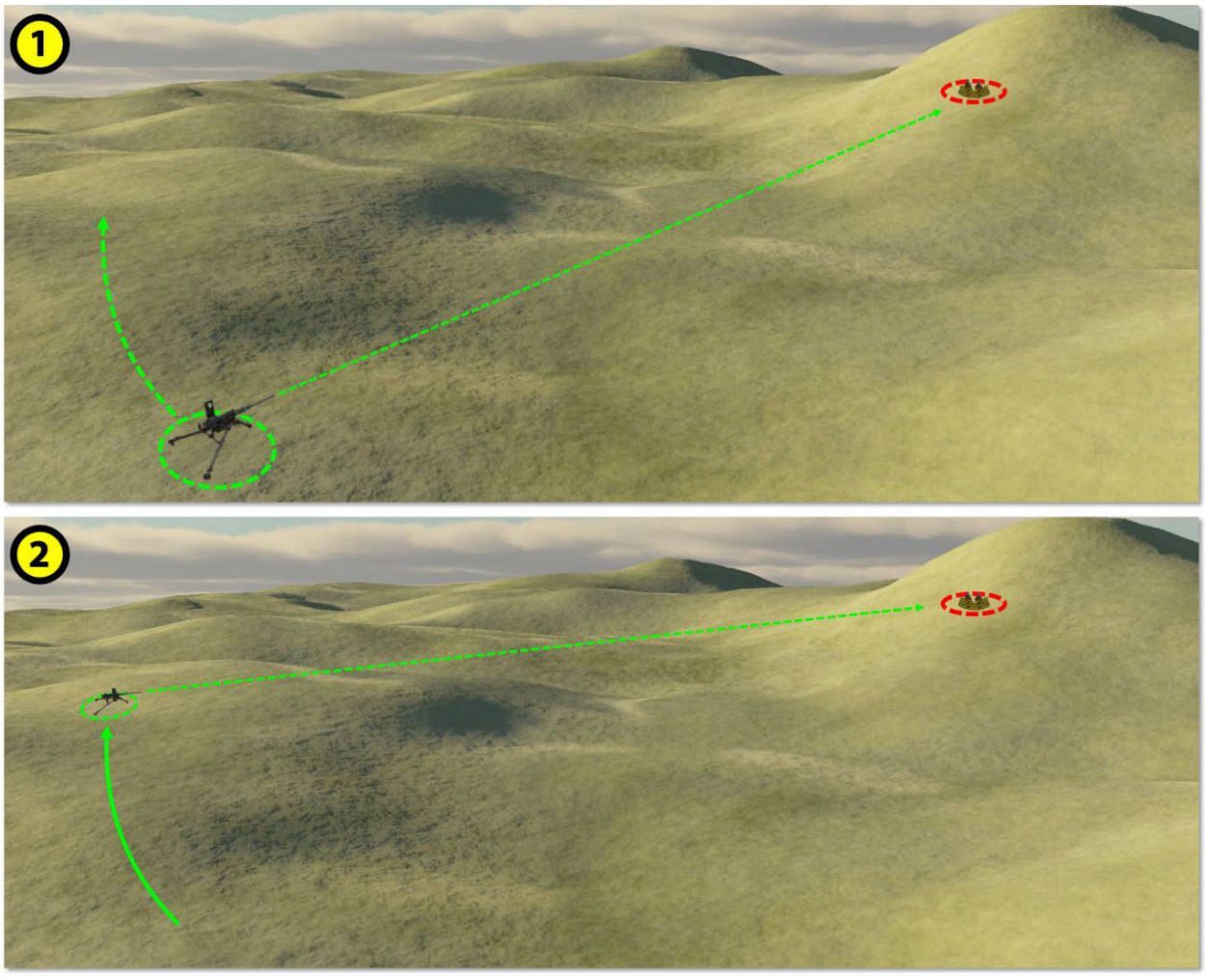
In some tactical situations, the best way to employ your machine guns is to engage with all guns simultaneously to mass maximum effective fire and overwhelm the enemy as quickly as possible. However, in other cases it can be more advantageous to open fire with individual guns in sequence. This means having one gun open fire first but waiting before opening fire with the second gun. There are a number of ways to do this that we will discuss more later on but the general reason for employing sequential fire is because it keeps the enemy off balance by forcing him to react to a changing situation and multiple threats. When you open fire with the first gun, the enemy will react accordingly and begin to maneuver and make decisions focused primarily on that single gun. When the second gun opens fire it will likely take the enemy by surprise and force him to rapidly adjust his plans, position and maneuvers accordingly. It is also possible to use the first gun to force the enemy into taking actions that will leave him more vulnerable to the second gun. In the example below, the enemy starts off moving in a file (1) but when the green gun opens fire, the enemy comes on-line behind a berm to take cover from the green gun's fire (2). However, while protecting themselves from the green gun they unknowingly line up to expose themselves to enfilade fire from the blue gun. If both guns opened fire at the same time this sequential trap would not work. We will discuss this tactic in more detail later on. Note that in the diagram below no cover/concealment is shown for demonstration purposes.



TACTICAL CONCEPTS: DISPLACING GUNS

Avoiding Indirect Fire and Keeping the Enemy Off Balance

One common mistake is to set up your machine guns in a support-by-fire position and leave them there for the duration of the engagement or attack. While this might work in some cases, if the enemy has indirect fire assets like mortars or artillery, they will most likely employ these assets against your support-by-fire position as quickly as possible. Therefore, if you leave your guns in place, they will most likely get hit with indirect fire. Therefore, it is best to displace (move) your guns as needed to make it more difficult for the enemy to employ indirect fires. Displacing your guns also generally keeps the enemy off balance and forces him to constantly react to your maneuvers. When stuck in this reactive mode or defensive mode the enemy will find it more difficult to take the initiative for himself. The example below shows one gun (marked in green) displacing from one position to another while continuing to engage the same target.



MACHINE GUN EMPLOYMENT
Fire Control and Control Measures

Fire control or Direct Fire Control Measures (DFCM) are a critical component of effective machine gun employment. The previous section on tactical concepts explained key components of the deeper logic of how machine guns fight on the battlefield, but it did not go into specifics to answer the question of how to apply those concepts in a real combat situation. This section is the starting point for answering that second question.

Fire control might be compared to individual marksmanship skills. As an individual, you might have the most powerful gun in the world but if you randomly spray bullets in all directions, focus on the wrong targets, overlook important targets, and accidentally shoot at your friends you will not be an effective combat shooter. The same fundamental principles apply to machine guns at the unit level.

Many people think that fire control or DFCM are only about avoiding fratricide (friendly fire). While this is an important aspect of fire control, there are many other reasons why fire control is important. First, it allows for massing and concentration of fire on the most critical targets to destroy them as early as possible in the engagement. It also prevents focusing too much fire on any one target and neglecting others, or employing an inappropriate weapon for a specific target. Finally, it reduces the likelihood of accidentally shooting friendly forces and mitigates risk in combat operations.

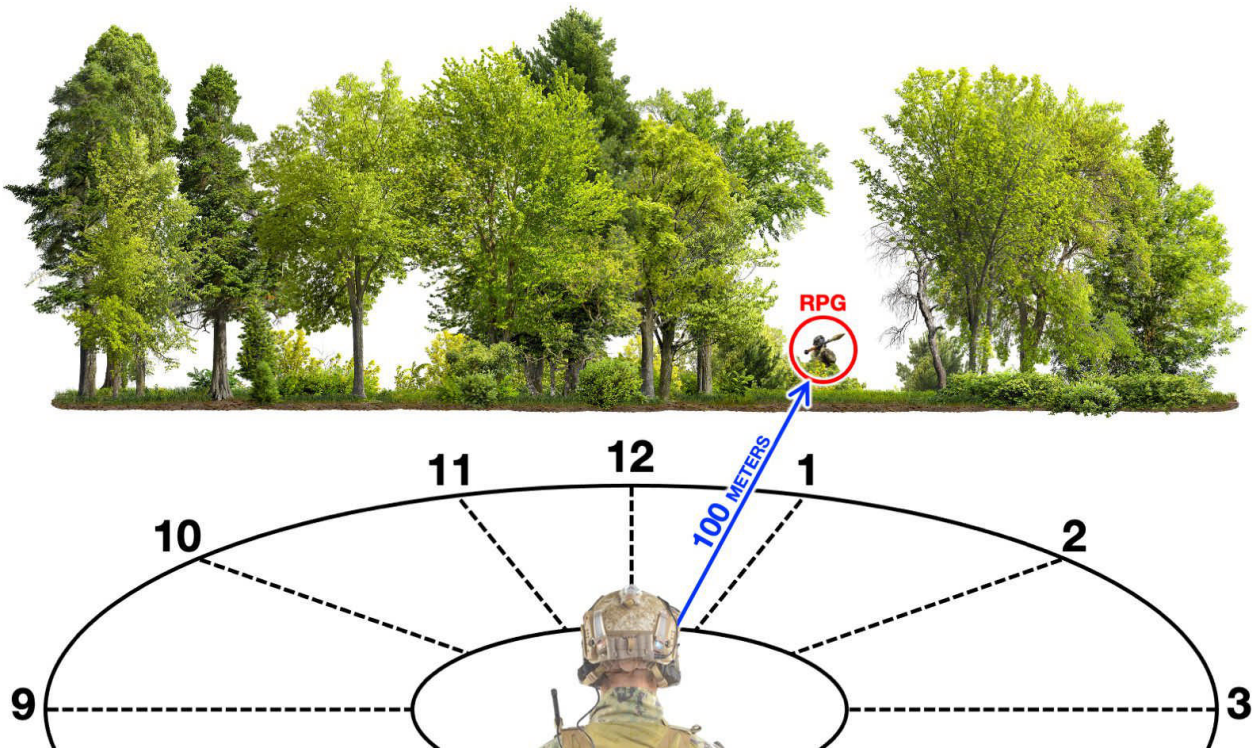
Fire control measures become particularly important when operating at night or in conditions of limited visibility, especially in high-stress situations. When troops are stressed and visibility is limited, it is easy to lose effective fire control. This can lead to less effective fires and potential accidents or fratricide. The effective use of range cards, machine gun's T&E mechanism and other improvised fire control mechanisms can help prevent mistakes and accidents in combat. While this section discusses range cards in some detail, it does not go into the specifics of how to fill out a range card since specific procedures can vary from unit to unit. Rather the intent is primarily to explain why range cards are important and how to apply them in a real-world combat situation.

FIRE CONTROL: ALERTS AND FIRE COMMANDS

Direction, Distance and Description

In order for a machine gun team to effectively engage a target, it must first pinpoint the enemy's location. This involves calling out the enemy's direction, distance, and description (abbreviated as the 3D's). Anyone in the unit can call out the 3D's since any member of the unit might have the best observation of the enemy. Once one trooper calls out the 3D's the others should echo the information throughout the unit so everyone knows where the enemy is. When you first make contact, you might not have all the information. You might initially only have a general direction. Call out the information you know as you try to learn more specifics. It is important to call out direction, distance, and description in that order since it makes it easier to find the target. First the shooter scans left/right to the direction, then searches along that line to the correct distance, then looks for the specific target at that location. The image below gives an example of how to call out the 3D's.

"CONTACT ONE O'CLOCK, 100 METERS, RPG"



FIRE CONTROL: ALERTS AND FIRE COMMANDS

Detailed Fire Commands

The "3 D's" of direction, distance and description are often used when making chance contact with the enemy and offer the quickest way to disseminate the most critical information that will allow you to start returning fire on the enemy. However, in some cases you might want to provide additional information to your machine gun team in a more detailed fire command. The specific doctrine for fire commands differs somewhat between services and countries. In many cases, doctrine suggests rattling off a long list of commands micromanaging every aspect of the machine gun fire from the rate of fire to the way the gunner manipulates or rotates the gun. While in some cases this might be useful, for our purposes we will focus on the key elements of a fire command with the most practical application.

Alert – In some cases, particularly if you are issuing fire commands over the radio, you will need to begin by identifying who you are talking to, calling out the specific gun team(s) whose fire you wish to control.

Direction, Distance and Description – Some of these can be left out if they are obvious or the target was already identified earlier. Note that when giving the location of the target, you do not have to use the clock method but can instead use other types of reference points if needed. We will discuss this more later in this section.

Rate of Fire – The leader might want to specify that a gun use a particular rate of fire in order to track ammo expenditure and to ensure there is an adequate volume of fire delivered on target.

Execution – This is where the leader specifies when the gun should open fire. The most common examples of this are listed below:

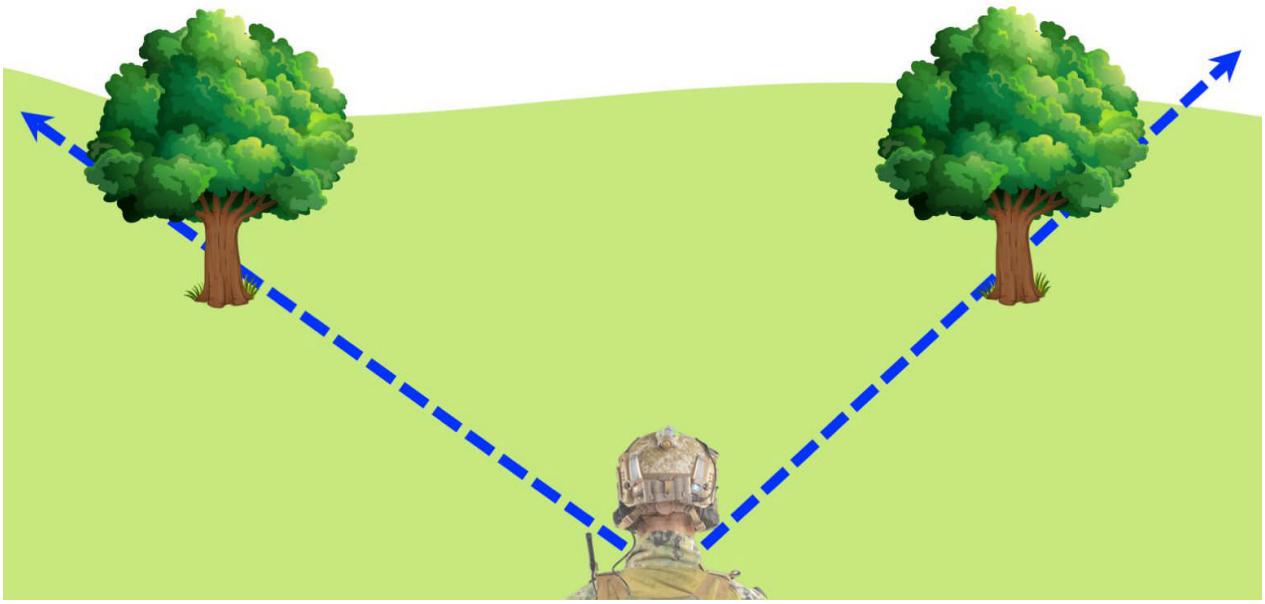
- Fire (fire now)
- Fire at will (you are free to fire when you decide)
- At my commend (wait for my command to fire)
- On my shot (fire when I fire)
- On _____ (specify some other control measure such as a pyrotechnic signal)

Once again, these are only a few examples of additional, more detailed fire commands that you can issue to your machine gun teams. Depending on your unit's doctrine, there are other elements of the fire command that you might insert such as weapon/ammunition type, method of engagement, method of control, target assignment and fire termination. Add these elements as needed if they support your specific mission requirements. However, the command elements listed above are the most commonly used and most likely to prove helpful in most situations.

FIRE CONTROL: SECTORS OF FIRE

Left Limit and Right Limit

In order for sectors of fire to be useful, the individual troopers who are covering those sectors must have a clear idea of the left limit and right limit of their sectors. It is up to small unit leaders to go from position to position assigning left and right limits to each position or trooper. Machine gun positions will be included in this process. When assigning left and right limits, it is important that sectors overlap so no area is left uncovered. it is helpful to use reference points on the ground if they are available. In the example below, the trooper's sector extends between the two large trees. It is also possible to assign sectors using specific compass azimuths. Writing down compass azimuths can be useful as a redundant measure. If a trooper forgets the reference point, he/she can pull out the compass to re-verify the sector. However, when under fire, troopers will probably not have time to reference their compass to determine their sector. If no reference points are available, the squad can plant aiming stakes to mark the left and right limits of each sector.



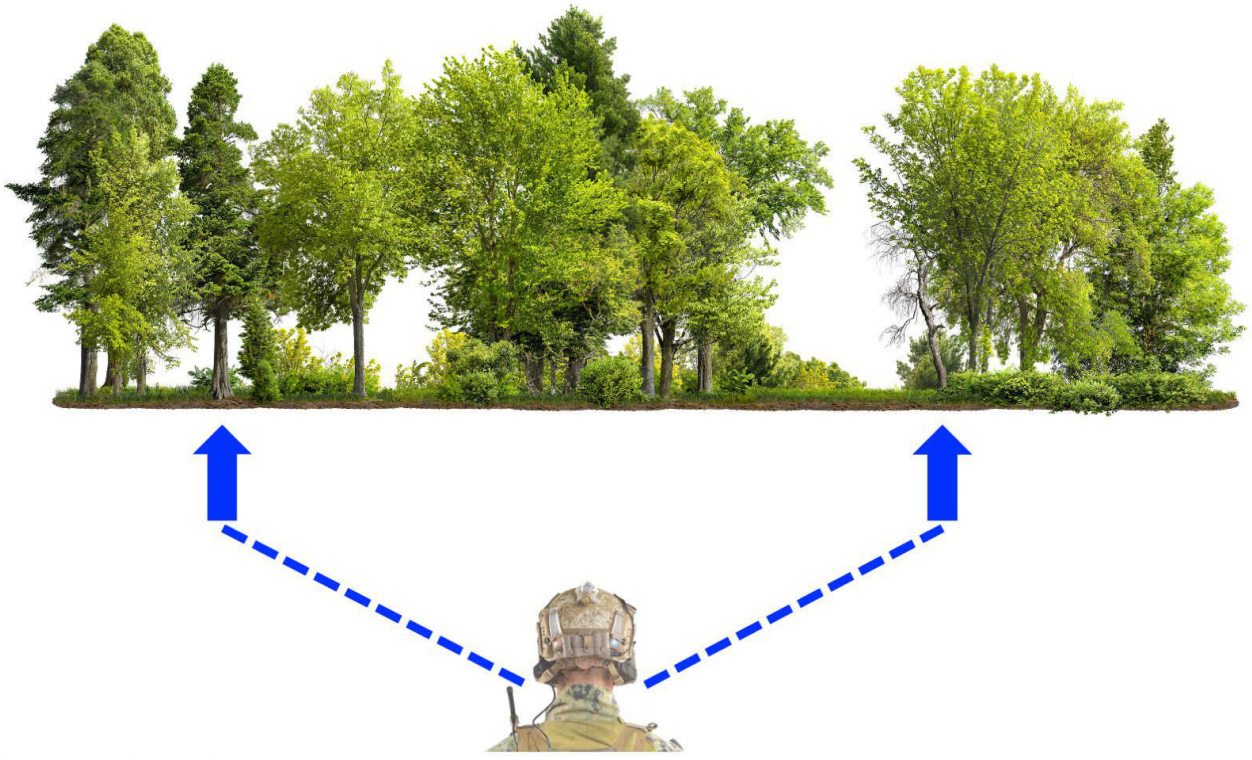
FIRE CONTROL: SECTORS OF FIRE

How to Assign Sectors

It is very unlikely that there will be two large trees in the open in just the right position to mark the limits of a sector. In reality, the terrain is more likely to look like the picture below. It is a common mistake for leaders to move hastily and simply point and say, "your left limit is that dead tree and your right limit is the crooked tree… got it?" without bothering to verify that the trooper has actually identified the left and right limits. This is problematic, especially at night. Given the left and right limits depicted in the image below, what follows is an example of a more reliable way to assign sectors. Every time the leader asks a question he/she must get a response or confirmation from the trooper…

RIGHT LIMIT: You see the clump of trees right in front of you? Look to the right. Do you see the open area? Ok, just to the right of that open area is a dead tree leaning to the left with some dead branches coming out on the left. Do you see it? Yes? Ok that is your right limit.

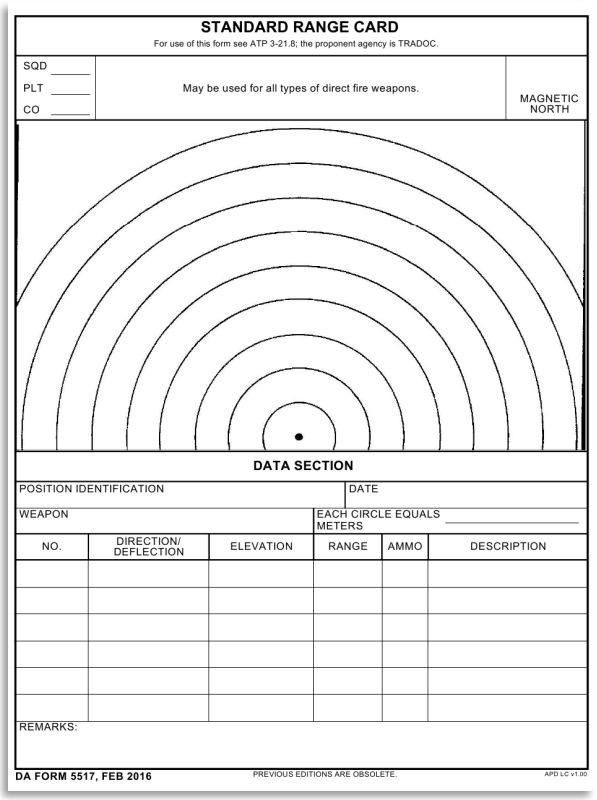
LEFT LIMIT: You see the clump of trees right in front of you? Look to the left until you see the first open space. There is one tree with a thin trunk growing up through that open area, do you see it? Ok, to the left of that tree are some bushes on the ground. Just to the left of those bushes is a thin, evergreen tree with a small bush behind it. Do you see it? Yes? Ok that is your left limit.



FIRE CONTROL: RANGE CARDS

Range Card Uses

In simple terms, range cards take sectors of fire a step further by drawing sectors in more detail and making note of specific angles, ranges, and terrain reference points. Filling out range cards is a common tasks in many infantry units and schools, so common in fact that troopers often fill out range cards robotically without giving any thought to what the card might actually be used for. Gunners sometimes forget that in many ways the range card is not as for their own use but rather a tool to help their leaders or to assist someone who must man the gun in the gunner's place. Therefore, it is critical to prepare the range card not just so you can understand it but so someone else can understand it. Leaders will use range cards to help them incorporate multiple guns into a larger defensive plan or perimeter and prepare the associated defensive sector sketches. Range cards are also important for providing a quick orientation or reference for someone else who must man the gun in an emergency. For the gunner, depending on the terrain and the situation, some areas or boxes on the range card might prove more useful than others. The bottom line is to practice filling out and using range cards as a unit and determine what information is the most useful to both gunners and leaders based on your specific mission requirements. You can then focus on filling out the range card in a way that best serves your needs, rather than just filling it out robotically without thinking.



STANDARD RANGE CARD

For use of this form see ATP 3-21.8; the proponent agency is TRADOC.

SQD _____
PLT _____
CO _____

May be used for all types of direct fire weapons.

MAGNETIC NORTH

DATA SECTION

POSITION IDENTIFICATION			DATE		
WEAPON			EACH CIRCLE EQUALS _____ METERS		
NO.	DIRECTION/ DEFLECTION	ELEVATION	RANGE	AMMO	DESCRIPTION

REMARKS:

DA FORM 5517, FEB 2016 PREVIOUS EDITIONS ARE OBSOLETE. APD LC v1.00

FIRE CONTROL: RANGE CARDS

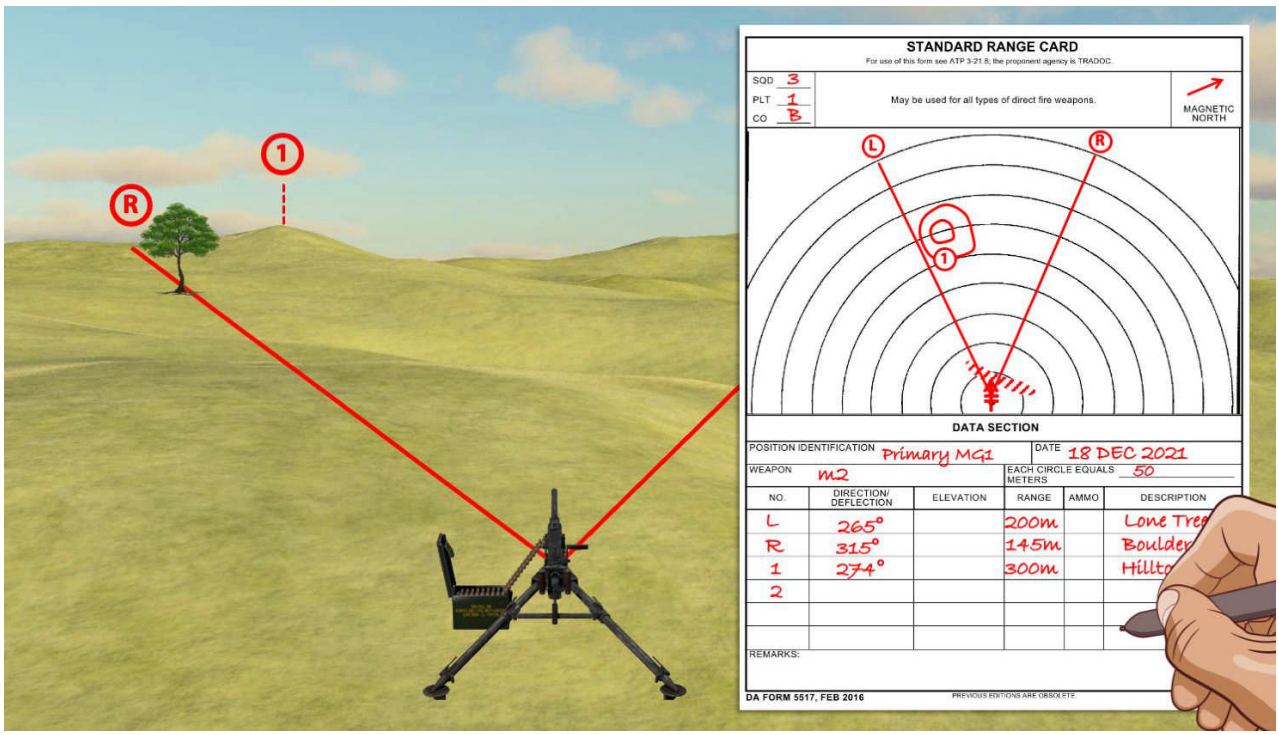
Range Card Basics

While we will not go into detail on every step of filling out a range card in this book, the following sections offer a basic introduction to some of the most important elements on the range card, excluding the "final protective line" which will be covered in a separate section. Also note that the example range card below is not yet complete and is only intended for generalized explanation purposes.

Sectors of Fire - In most cases you will want to establish both a primary and a secondary sector of fire, each with left and right limits. As already explained, the gunner should be able to identify the right and left limits with easily recognizable terrain features. As a redundant measure, the gunner should also write down the azimuths and ranges of these terrain features.

Dead Space – On a range card or sector sketch, dead space is represented by diagonal hashed lines. Identifying dead space within the sector is critically important to help anticipate where enemies might hide or take cover from your fire.

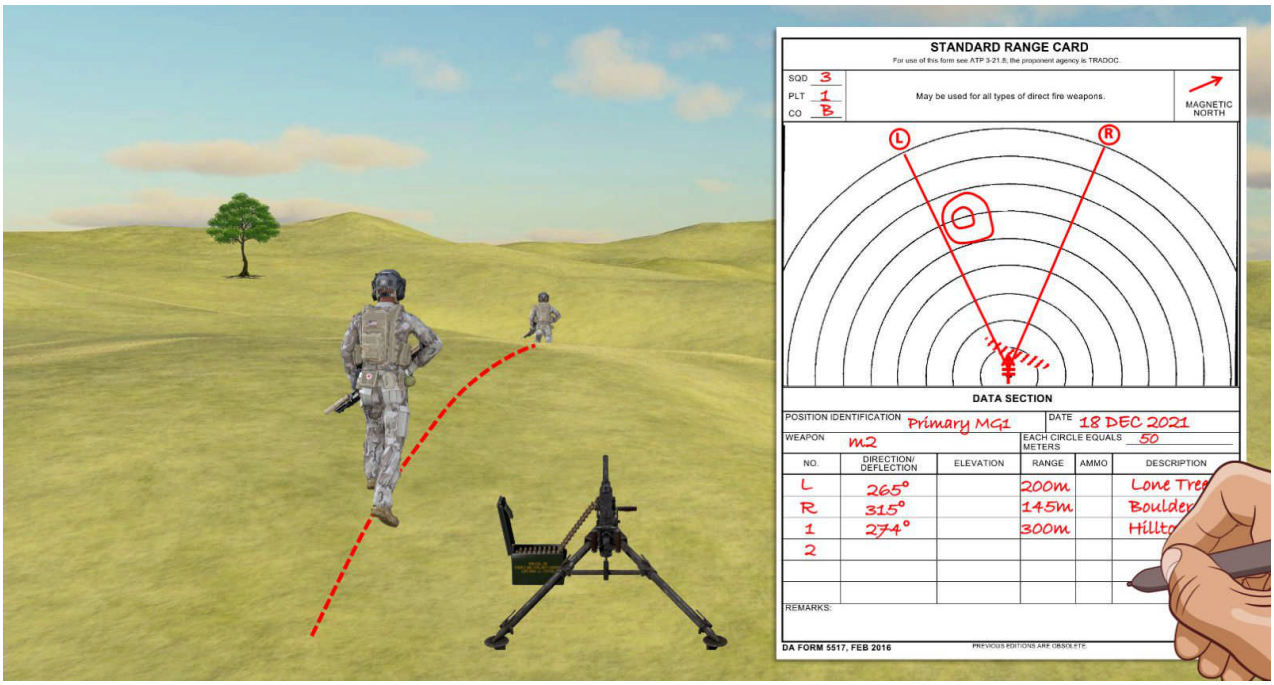
Reference Points – Identifying easily recognizable terrain features and drawing/marking them on the range card can help you estimate ranges when engaging targets within your sector. Such reference points are not as relevant in terrain with limited observation range.



FIRE CONTROL: SCOUTING FIELDS OF FIRE

Pinpointing Dead Space, Reference Points and Key Terrain

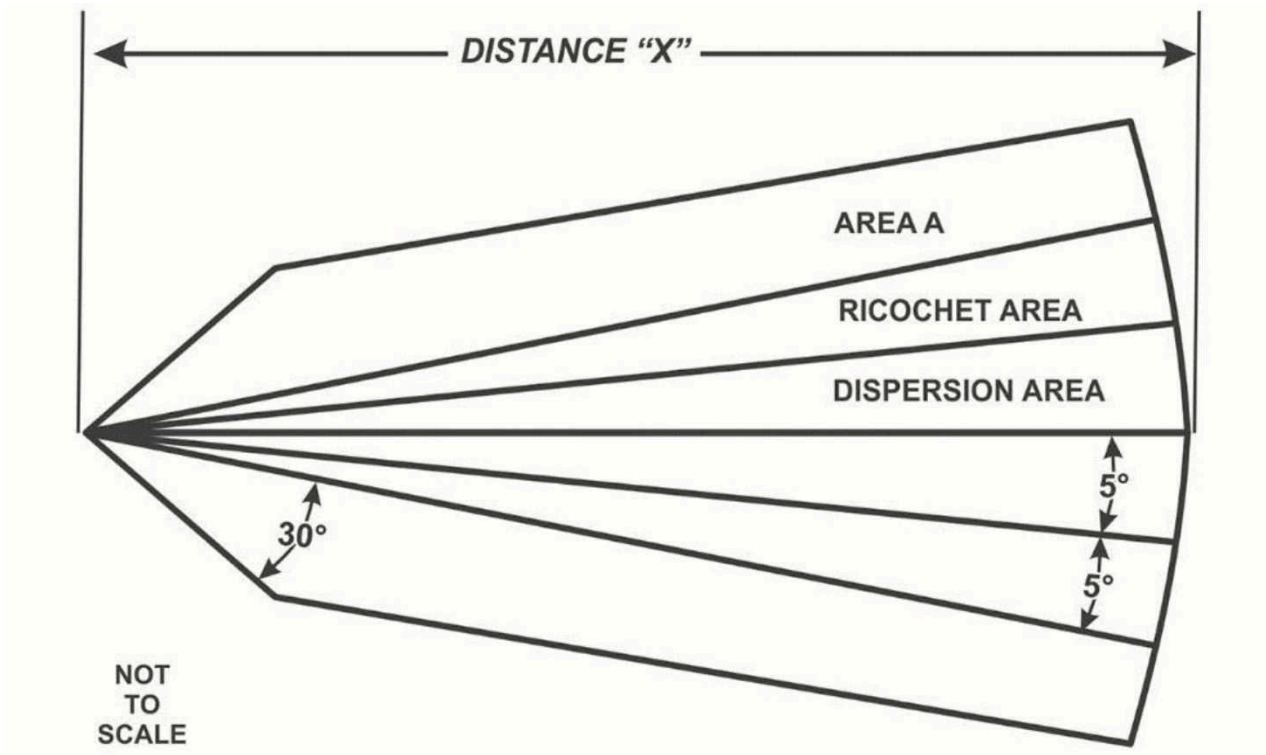
As already discussed, identifying dead space is one of the most important steps when filling out a range card or establishing a defensive sector in general. In some cases, the tactical situation might make it impossible to physically walk forward of the gun to scout out dead space and terrain reference points for the gun. However, if time and the situation permit, it is much better to physically scout the terrain than to just guess based on a visual assessment from the gun position. To accomplish this the gunner will remain manning the gun while another trooper (generally the assistant gunner) will walk forward based on the gunner's guidance. By measuring his/her pace count, the assistant gunner can help precisely determine the distance, orientation, and size of dead space within the sector, as well as the precise location of reference points and key terrain features. It can also be useful to leave markers at specific ranges positioned so it is easy to identify when enemy troops pass by or in front of the markers. In the example below, the assistant gunner's lower body disappears into a dip in the terrain, identifying a strip of dead space running laterally in front of the gun. Before you or someone else moves forward to scout a sector be sure to notify all troops that you are moving so someone does not mistake you for the enemy. In addition, if troops are constantly walking in and out of the perimeter to scout sectors, that might cause those providing security to grow complacent and mistake an actual enemy for a friend. Therefore, as already stated, there are times when physically scouting fields of fire is not the best option. Using a laser range finder can be an effective and quick alternative to physically walking the terrain but it will not provide as complete or detailed information.


STANDARD RANGE CARD
SQD 3
PLT 1
CO B
May be used for all types of direct fire weapons.
MAGNETIC NORTH
L
R
DATA SECTION
POSITION IDENTIFICATION Primary MG1
DATE 18 DEC 2021
WEAPON M2
EACH CIRCLE EQUALS METERS 50
NO. | DIRECTION/ DEFLECTION | ELEVATION | RANGE | AMMO | DESCRIPTION
L | 265° | | 200m | | Lone Tree
R | 315° | | 145m | | Boulder
1 | 274° | | 300m | | Hillto
2
REMARKS:
DA FORM 5517, FEB 2016
PREVIOUS EDITIONS ARE OBSOLETE.

FIRE CONTROL: SURFACE DANGER ZONES

Planning for Bullet Dispersion and Ricochet

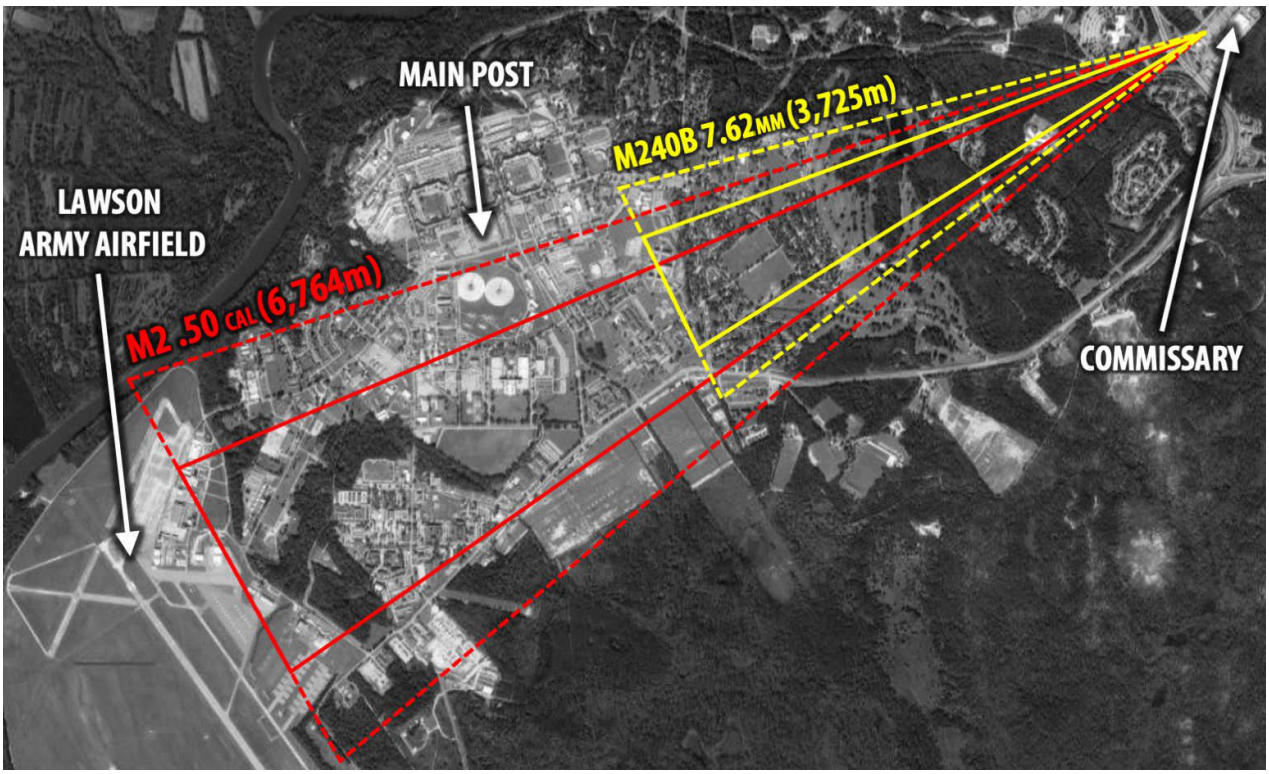
The diagram below is taken from the U.S. Army's Infantry Squad and Platoon field manual and gives a visual representation of how the U.S. Army calculates surface danger zones for direct fire weapons. Different services and countries might take slightly different approaches but the general concepts and approximate calculation values remain consistent. Explaining the diagram, "distance X" at the top represents the maximum range (not to be confused with the maximum effective range) of the machine gun. The horizontal line represents the gun's aiming direction. 5-degrees to either side of that is the dispersion area, which represents the area where bullets are likely to disperse based on movement of the gun and the cone of fire. An additional 5-degrees to either side of the dispersion area is the ricochet area. This is the area where bullets might disperse due to ricochets. Therefore, when emplacing a machine gun, it is unsafe for friendly forces to be anywhere inside a 20-degree arc extending out to the gun's maximum range. We will discuss ways of using these measurements later in this section. At this point it is mainly important to understand what the various parts of the diagram mean.



FIRE CONTROL: SURFACE DANGER ZONES

A Visual Example of Surface Danger Zones

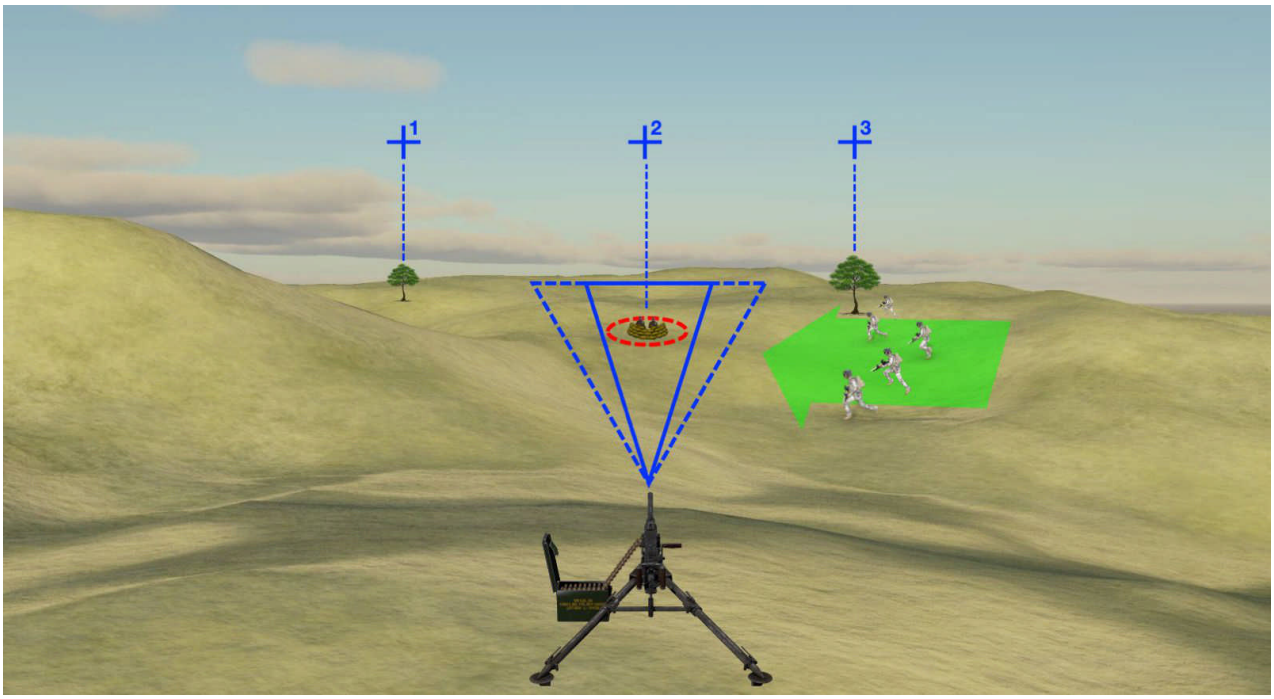
To fully understand how big surface danger zones actually are on the battlefield, it can be helpful to perform some calculations on a map or satellite image of your home town or post. For this example it is difficult to pick a location that all readers will be familiar with but it is likely that many people reading a book on infantry tactics will be familiar with Fort Benning, Georgia. The satellite image below depicts all of the Fort Benning main post and most of Lawson Army Airfield. If you placed a M2 .50-caliber heavy machine gun in the commissary parking lot and fired it towards Fort Benning, your bullets could reach all the way to Lawson Army Airfield and the danger zone where bullets might impact would cover most of the runway. An M240B 7.62mm medium machine gun would fly over the entire golf course and reach the Holiday Inn Express on the edge of main post. The danger zone would span almost the entire width of main post. If you are not familiar with Fort Benning, it can be useful to perform this same exercise in an area you are familiar with. It surprises most people to see just how far and how wide machine gun bullets can reach. Remember, a bullet will not stop until it runs out of energy or impacts something solid. Therefore, any school that is teaching weapon safety will teach you to identify your target and what is beyond your target, to ensure your bullets do not go through or past your target and hit an innocent person. When your bullets have the ability to travel as far as 6,764 meters past your target, this aspect of safety planning is all the more important.



FIRE CONTROL: SHIFT FIRE, CEASE FIRE AND LIFT FIRE

STEP 1: Establish TRPs and Signals Before Maneuvering

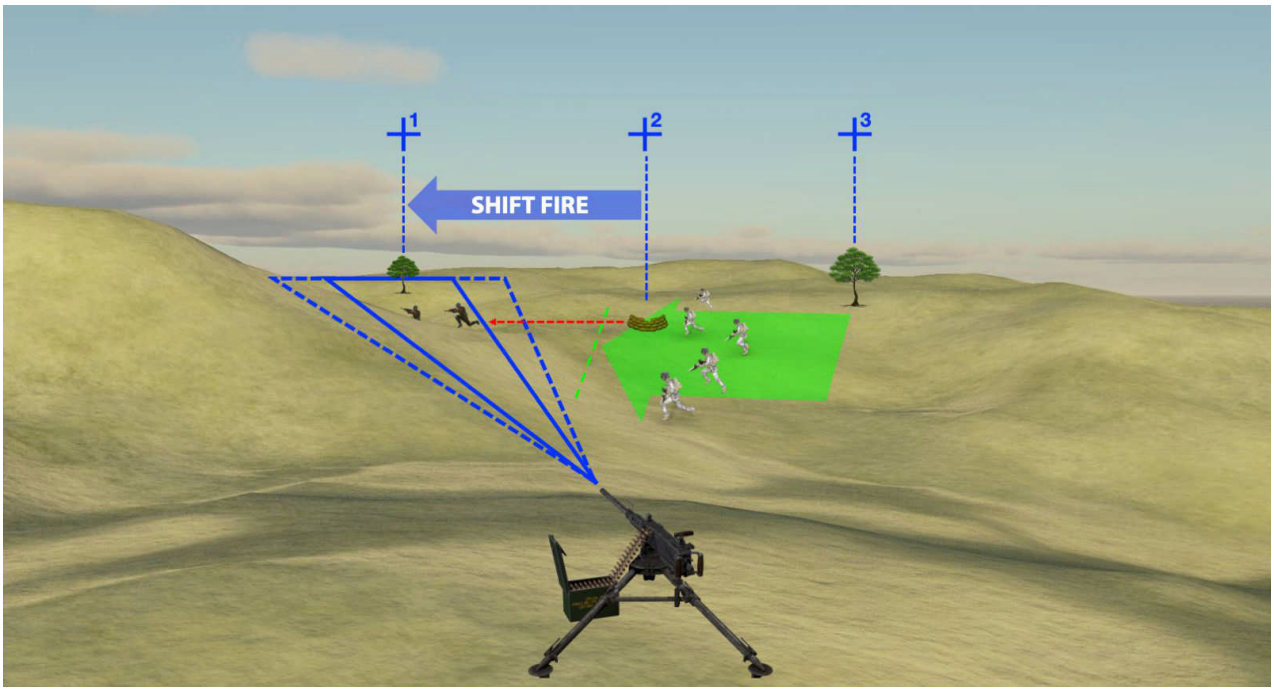
Given the previous discussion of surface danger zones, it is very important to ensure friendly troops do not accidentally maneuver into areas where they might accidentally get hit by your machine gun bullets. This becomes a particular problem when an assault element (green arrow) has to conduct a flanking assault on an objective (red circle) that you are suppressing with a machine gun as in the example below. If you continue to fire on the enemy position while friendly troops assault through you will risk shooting your own people. Therefore, it is important for the leader and machine gun team to established prearranged shift fire signals and control measures on the ground. In this example, the squad/platoon leader identified three Target Reference Points (TRPs) marked with blue crosses on the example below. The machine gun starts by firing between TRP1 and TRP2, focusing on TRP2 which is the enemy position. If the gun fires further to the right, bullet dispersion or ricochets might hit friendly troops. As the friendly troops flank, prior to reaching the lone tree on the right (TRP3) they will give the shift fire signal to the gun and confirm that fire has shifted before continuing forward. It is important in this case that both the gunner team and the assault element can identify TRP3 on the ground. It is also important to have effective and redundant communications methods for communicating the shift fire signal/command. Finally, note that this example uses obvious reference points in open terrain. In real combat on real terrain, identifying reference points for fire and maneuver might be much more difficult.



FIRE CONTROL: SHIFT FIRE, CEASE FIRE AND LIFT FIRE

STEP 2: Machine Gun Shifts Fire to the Left of TRP1

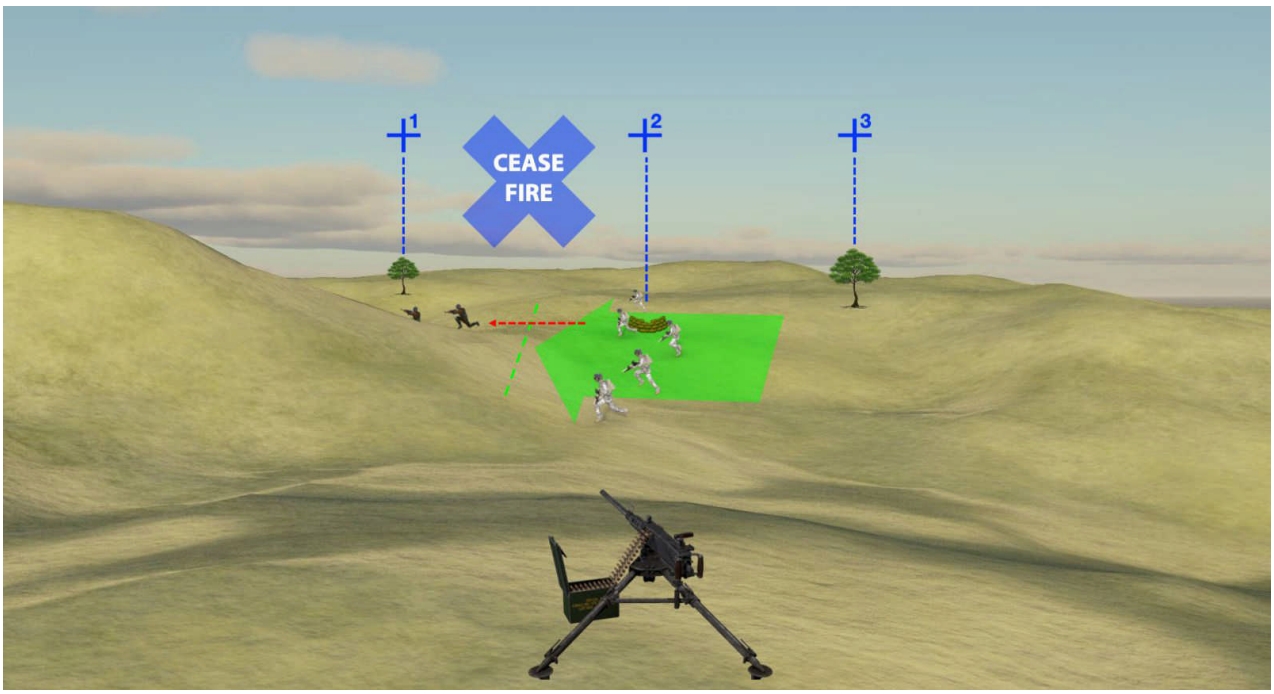
After receiving the shift fire signal, you will shift fire to the left of TRP1. Note that means that your right-most point of aim will be TRP1. As shown in the image below, that does not mean bullet dispersion and ricochets will not spread to the right of TRP1. As the assault element crosses the objective the enemy will most likely pull back (dotted red line). After shifting fire, your new field of fire will continue to engage the enemy forces as they move to your left. However, the assault element must stop at some point or they will run into your field of fire as well. Therefore, in addition to the other control measures the assault element must have a Limit of Advance (LOA) which is marked with a green dashed line in the example below. The LOA does not necessarily need to be tied to a terrain feature on the ground and in many cases it is just one bound (or 3-5 second buddy rush) past the end of the objective. However, note that the objective might be larger than what you could see from the initial gun position before flanking and if you are not careful you might accidentally push too far forward if you become disoriented. This is particularly challenging in dense terrain, at night or in low visibility conditions. The important thing is that both the gun and assault team are on the same page to ensure the assault team stops before assaulting into the path of the gun.



FIRE CONTROL: SHIFT FIRE, CEASE FIRE AND LIFT FIRE

STEP 2 (Option 2): Cease Fire or Lift Fire

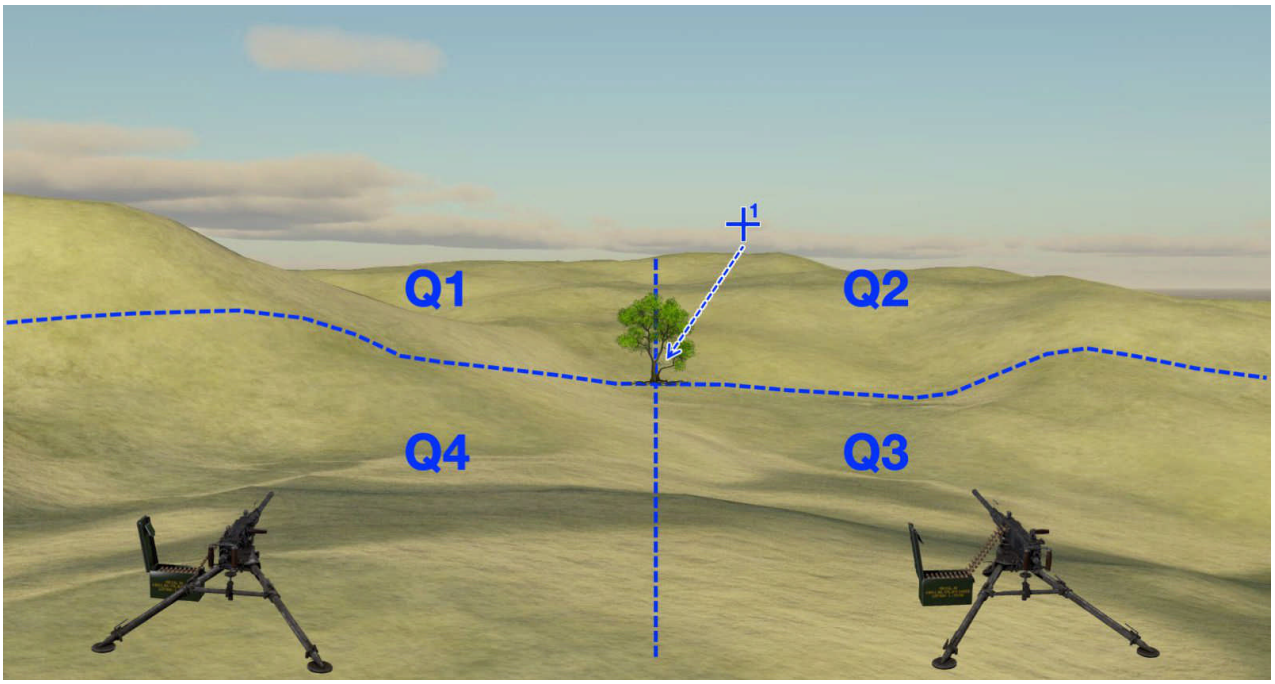
As already discussed, shifting fire safely can be difficult, especially in dense terrain, at night or in limited visibility. There is always the possibility that you will accidentally shoot your own troops if you continue to fire as they assault the objective. For this reason, the safer option is sometimes to cease fire all together. The disadvantage of this is that it takes pressure off the enemy who might turn around and resume fighting when they hear the machine guns stop firing. However, there are ways to mitigate this risk by employing an additional gun in a local support position. We will discuss those options later on. Another option is to "lift" fire. Many people mistakenly think lift fire means to stop firing, just like cease fire. However, according to doctrine, lifting fire means actually lifting the trajectory of the bullets so the beaten zone remains the same, allowing troops to maneuver under the arc of the machine gun's bullets. This can be difficult to achieve in real-world combat conditions and as already discussed, employing higher-angle machine gun fires can be difficult or impractical in many cases. Finally, firing over the heads of friendly troops is always dangerous so for these reasons we generally discourage trying to use the lift fire technique. However, in certain situations and certain types of terrain the lift fire technique might be appropriate as long as it is used with extreme caution.



FIRE CONTROL: OTHER TYPES OF SECTORS

Quadrants and Sectors in Depth

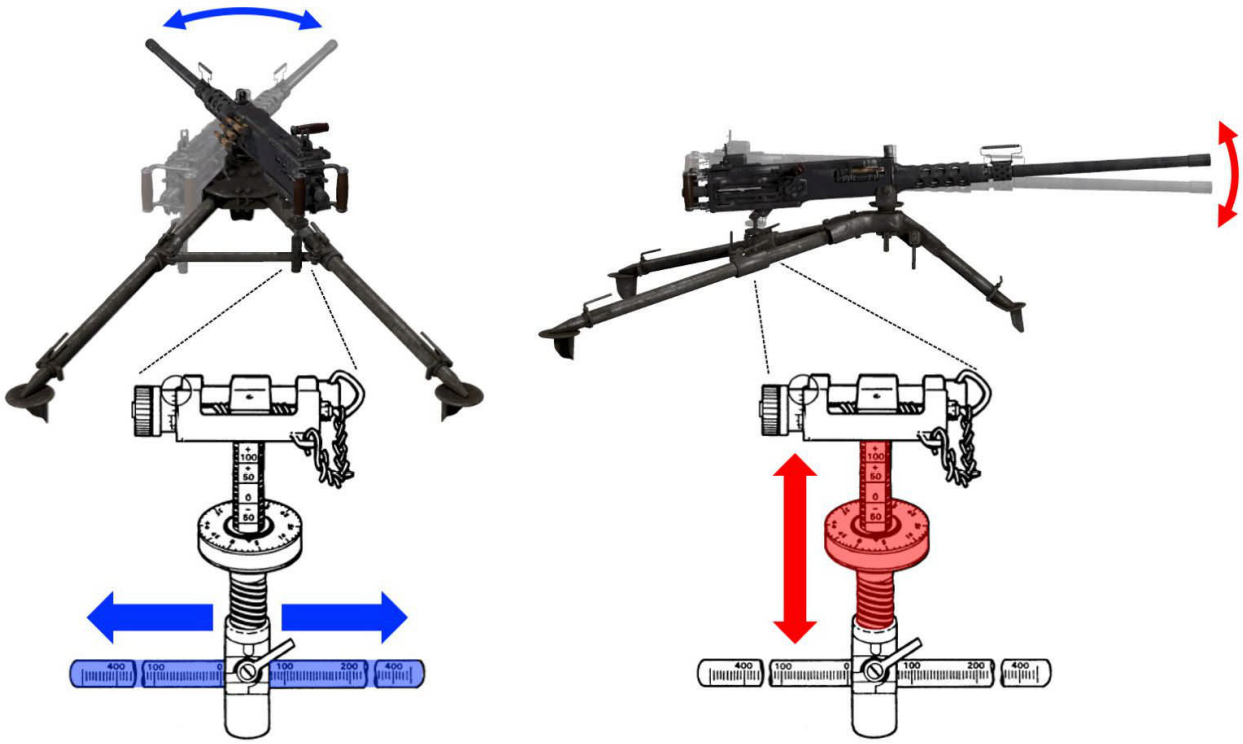
There are many other control measures you can establish on the surrounding terrain and your tactical map, as well as other ways to divide fire into different sectors. Two more worth mentioning are the quadrant method and sectors in depth. The quadrant method, depicted below uses a single target reference point (TRP) as the center point for four quadrants. You can label the quadrants however you like. In the example below they are labeled Q1-Q4. If you have multiple units or guns you can assign them to focus their fire on a specific quadrant. The illustration below also allows for assigning sectors in depth. For example, you might assign the gun on the right to engage targets beyond TRP 1 (quadrants 1 and 2) while the gun on the left engages targets closer than TRP 1 (quadrants 4 and 3). When using this system it is important to remember that because you have only a single, central TRP defining the precise limits of sectors can become confusing, particularly at night. This problem becomes even more challenging if guns displace and are suddenly looking at the central TRP from a different angle. Therefore, the quadrant and sectors in-depth method can be effective, but you may need to apply some additional control measures along with the quadrants to ensure safety.



FIRE CONTROL: TRAVERSING & ELEVATING MECHANISM

Traverse and Elevation Overview

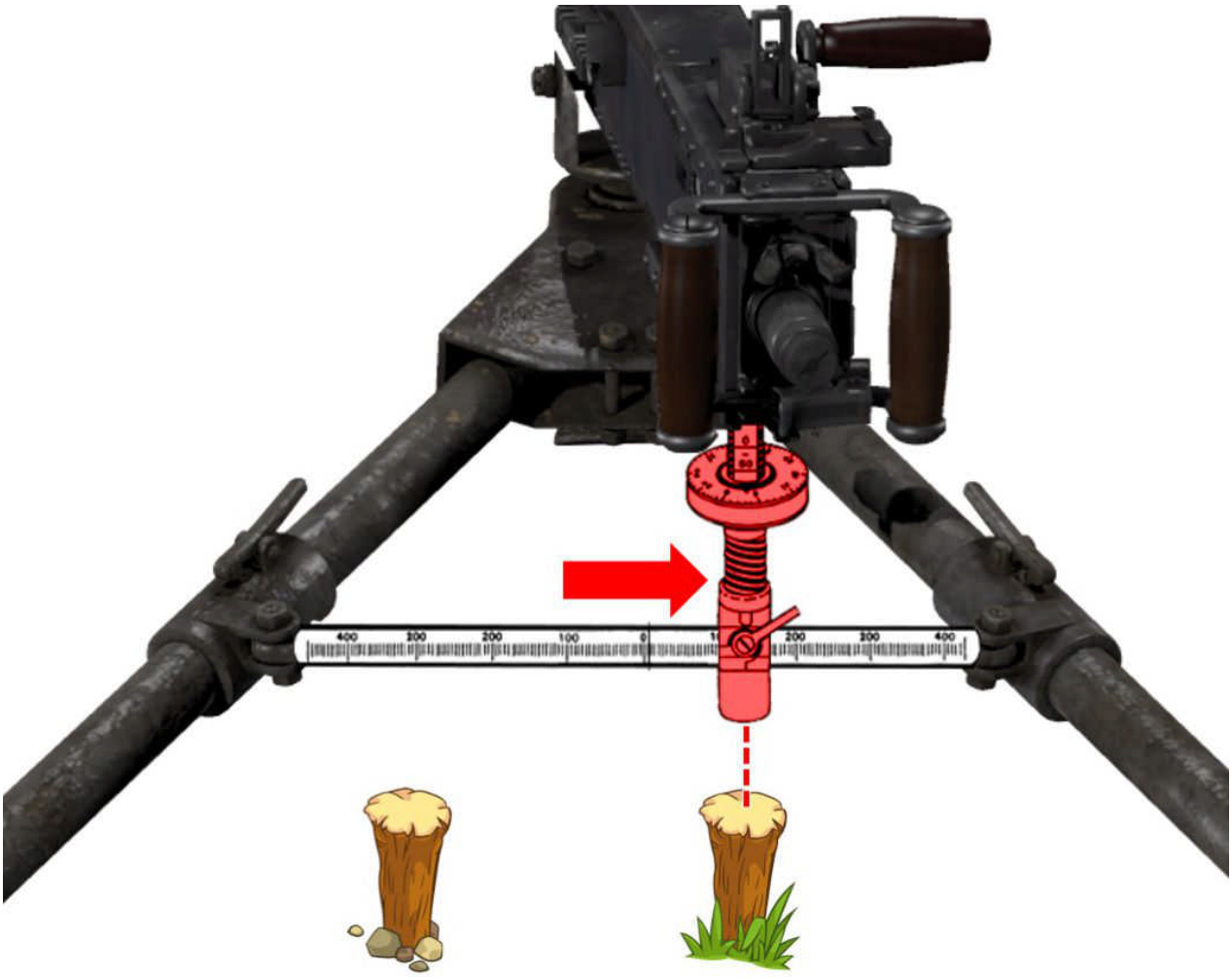
The traversing and elevating mechanism (T&E) is a tool that can help you control your machine gun fire and dial in specific TRPs. The T&E attaches to the tripod as shown by the black dotted lines below and slides back and forth along the tripod's traversing bar (blue), allowing the gun to traverse from left to right. The elevating screw and handwheel (red) allow the gun to elevate and depress (move up and down). There are several different types of T&Es you might encounter and they all operate slightly differently. However, their core function is generally the same. Most T&Es will have a series of knobs or controls to make faster adjustments or finer adjustments to the gun's position. On most T&Es, traverse and elevation settings are measured in mils which is an angular measurement that is finer than degrees. There are 6400 mils in a circle as opposed to 360-degrees. By associating different traverse and elevation settings in mils with different TRPs and fire control measures, it is possible to precisely engage these TRPs in low visibility without needing to actually see the target. In short, the T&E allows you to record your "favorite settings" on a range card or note pad so you can return to these settings quickly. However, also note that having the T&E attached makes the gun slower to manipulate and restricts the gun's movement substantially. Most T&Es prevent you from traversing the gun outside an approximately 50-degree arc to the left and right. Most T&Es are easy to disengage quickly in an emergency.



FIRE CONTROL: TRAVERSING & ELEVATING MECHANISM

Reference Stake Technique

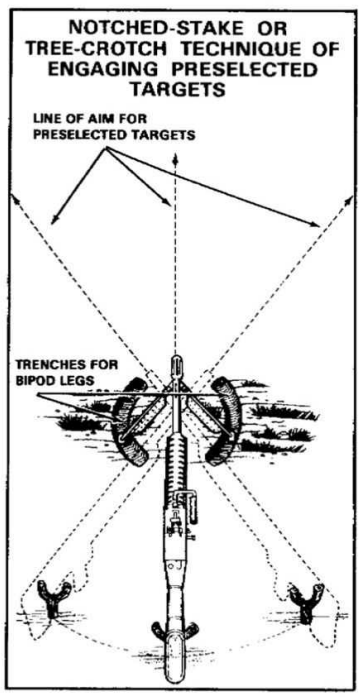
One useful technique for simplifying the use of the T&E is to plant reference stakes directly underneath the elevating mechanism (marked in red) that slides back and forth on the traversing bar. You can line up the reference stake directly underneath the elevating mechanism when the gun is pointed towards a specific target or setting. This allows you to quickly traverse the gun to a specific location by feel in the dark. You can also place a small piece of luminous tape on the elevating mechanism and the reference stake as a visual aid. While this improvised method might not be as precise as using the scale on the T&E, it is fast and can be executed in the dark. In the image below, the tops of the stakes are farther from the elevating mechanism for demonstration purposes. In actual practice, you might want to place the stakes closer so they are easier to align by touch only.

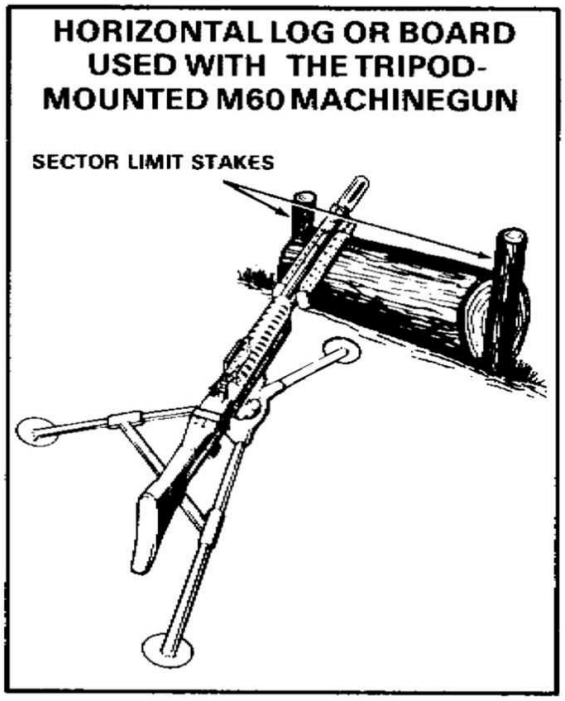


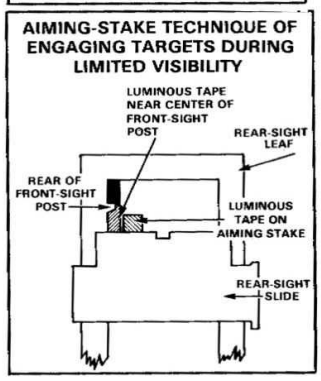
FIRE CONTROL: FIELD EXPEDIENT MECHANISMS

An Alternative to the T&E for Fire Control

In some cases you might want to use other field-expedient methods to control your gun's fire. There are many different techniques you can employ and we will not cover every one in detail in this book, since they pertain more to individual gunner skills as opposed to the bigger picture of machine gun employment. Some examples from older U.S. Army and USMC field manuals are pictured below. One of the most common field expedient techniques is hammering in sector stakes to block left and right limits for a gun in limited visibility. To engage predetermined targets you can wedge the gun in a Y-shaped tree crotch, set the front of the gun on a base-stake or align luminous tape on the edge of your gun sight with a reference point on a nearby tree or stick. It is important for leaders to ensure gunners know some of these traditional infantry techniques since in some cases they offer advantages over the T&E. For one thing you are not constrained by the T&E's mechanical limitations of the T&E. Second, field-expedient methods can be faster. If you build multiple firing positions, you can rapidly transition between different predetermined sectors and targets by simply picking up the gun and placing it in the new position. If you are using aiming stakes, you can simply aim the gun visually to engage predetermined targets. The main concern when using field expedient methods is that they may not be as precise as the T&E if they are poorly constructed. Therefore, it is critical to carefully construct all field-expedient fire-control tools so they are sturdy and offer minimal play in the gun's movement.


NOTCHED-STAKE OR TREE-CROTCH TECHNIQUE OF ENGAGING PRESELECTED TARGETS
LINE OF AIM FOR PRESELECTED TARGETS
TRENCHES FOR BIPOD LEGS

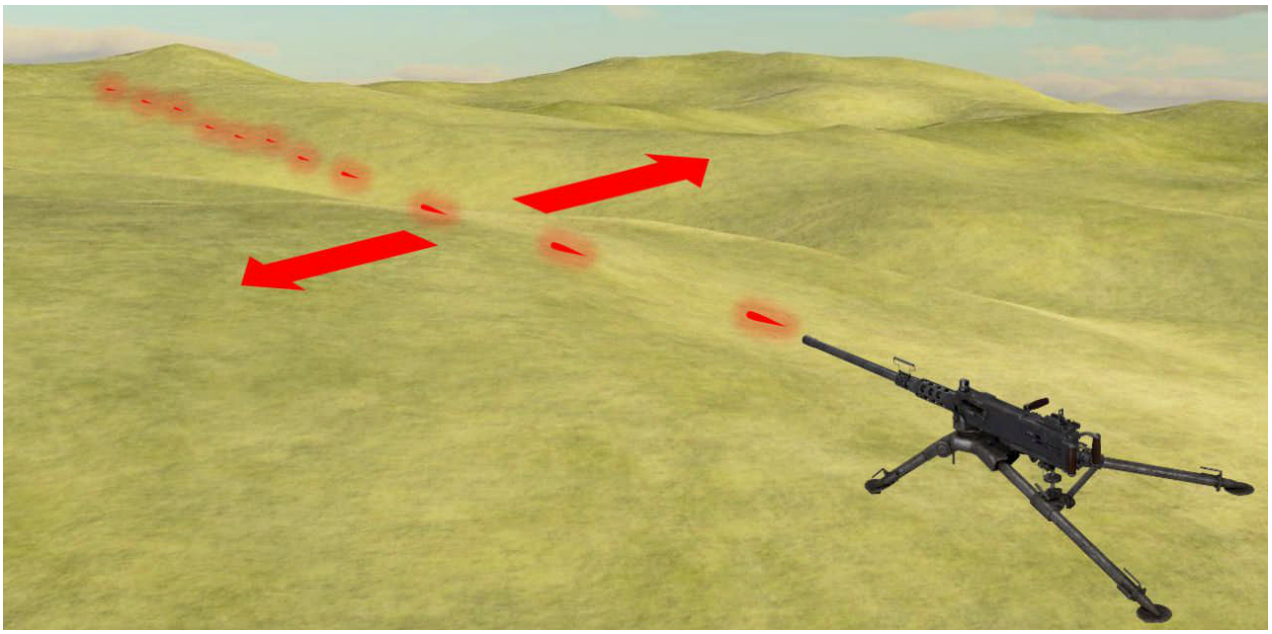



AIMING-STAKE TECHNIQUE OF ENGAGING TARGETS DURING LIMITED VISIBILITY
LUMINOUS TAPE NEAR CENTER OF FRONT-SIGHT POST
REAR-SIGHT LEAF
REAR OF FRONT-SIGHT POST
LUMINOUS TAPE ON AIMING STAKE
REAR-SIGHT SLIDE

FIRE CONTROL: TRACERS

General Description and Fire Control Applications

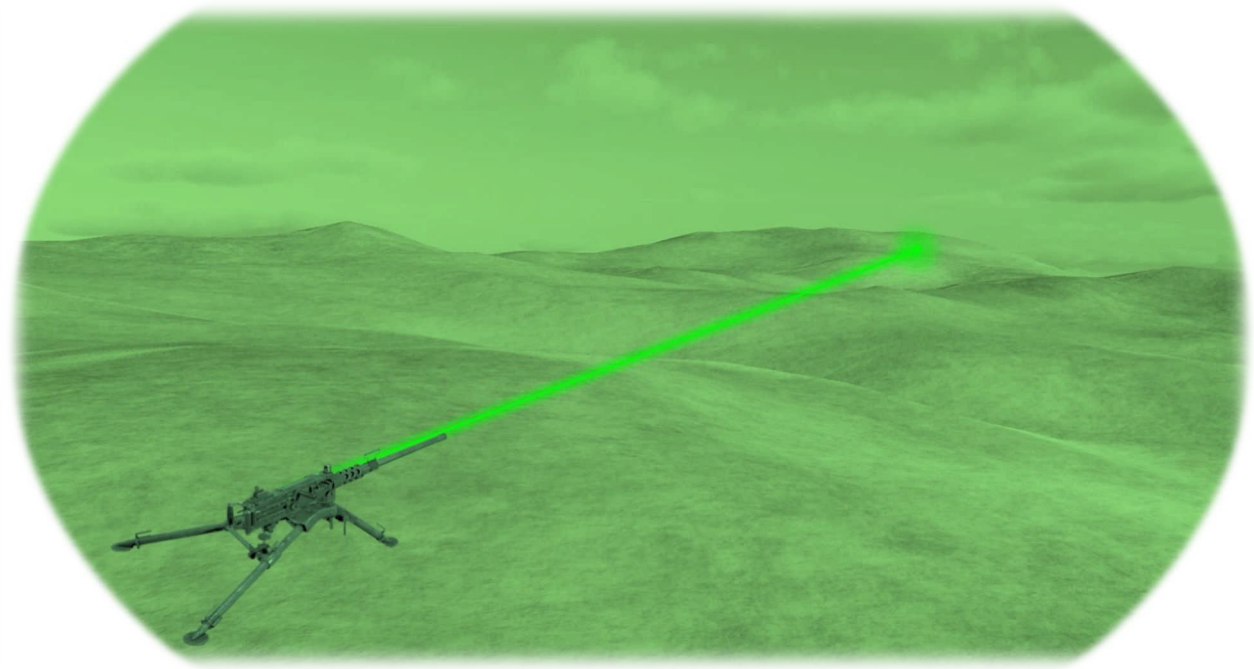
Another way to visually control a machine gun is by using tracer rounds or laser aiming devices. Tracer rounds include a small charge that when ignited burns brightly with a specific color. Therefore, as the bullet streaks through the air it will leave a lighted "trace" that you can follow all the way to the impact point. In simple terms, tracers allow you to see your bullets flying through the air in either day or night. This allows you to aim the gun without necessarily looking down the sight, walking the stream of bullets on to the target much as you would aim a stream of water from a hose. Tracer bullets also have an incendiary effect and can be useful for starting fires or igniting fuel in vehicles. Tracers are generally loaded in a "mix" with other rounds so not every round you fire will be visible flying to the target, only one out of every five rounds etc. There are many ways to use tracer ammunition for fire control. Tracers make it easier for observers to walk fire on to the desired beaten zone and leaders can fire tracers from their rifles to mark targets or sectors for machine gunners. However, the important thing to remember about tracers is that they "work both ways," meaning that while you can see them streaking towards the enemy, the enemy can see where they are coming from which reveals your position. It is also important to note that tracers "burn out" at a certain range. For example, when firing an M240B, tracer burnout for a 7.62mm M62 tracer round is 900m. This means that you will not be able to see the bullet stream past 900m. You must always take these factors into account when employing tracers in combat.



FIRE CONTROL: LASERS

General Description and Fire Control Applications

There are a number of different laser devices that can be helpful in fire control. Some are laser aiming devices that are attached to a weapon and can be used to aim the weapon at night. Others are laser pointers that are not attached to a weapon but leaders can use to point and signal on the battlefield. Most lasers are infrared (IR) which means that the light they produce is not visible to the naked eye and can only be seen when you are looking through Night Optical Devices (NODs). If the forces you are fighting against do not have NODs this allows you to signal freely with IR lasers without worrying about giving up your position. However, even irregular military forces are starting to employ NODs more and more, so in many ways the old rule of "tracers work both ways," is beginning to apply to lasers. An enemy wearing NODs will be able to see your laser and where it is coming from. Like tracers, there are many ways to employ lasers for fire control on the battlefield like pointing out left and right limits and identifying specific targets. Another advantage of lasers is they do not make noise like tracer rounds.



FIRE CONTROL: ENGAGEMENT PRIORITIES

Destroy the Greatest Threat with the Right Weapon

Engagement priorities are another type of fire control measure that help you accomplish two main goals. First, they allow you to mass your firepower to concentrate on destroying the greatest threat first. This relates to the earlier discussion of fire concentration and the example where two guns focused on destroying the vehicle-mounted heavy machine gun first before engaging dismounted infantry. In the example, eliminating the enemy's decisive weapon system tipped the scales of the engagement early and gave you an advantage for the rest of the engagement. However, engagement priorities also serve another important goal, ensuring that you employ the best weapon for dealing with a specific target. This means that different weapon systems will have different engagement priorities. For example, even if enemy tanks present the greatest threat, it would not make sense to place enemy tanks as the priority target for a medium machinegun that is not powerful enough to cripple a tank. Rather, it makes more sense to assign crew-served weapons or light vehicles as the priority for medium machine guns while assigning tanks as the priority for anti-tank missiles. It can also help to assign priorities that offer an asymmetric advantage. An example of this is assigning your machine guns to focus on enemy anti-tank or surface-to-air missiles. These weapons present little threat to a machine gun but are very dangerous to tanks or aircraft. As a leader it is critical to clearly communicate these engagement priorities to all subordinate weapon systems. When a higher-priority target appears, the weapon should drop its current target and engage the priority target unless specified otherwise. The diagram below gives some example engagement priorities for different weapon systems that a leader might issue to subordinates. Note these priorities are meant only as a general example and you must come up with your own engagement priorities based on your own mission requirements.

Javelin ATGM	M2 HMG	M240B MMG	M249 LMG
1- Tanks 2- APCs	1- MANPADs 2- ATGMs 3- APCs 4- MGs 5- RPGs 6- Troops	1- MANPADs 2- ATGMs 3- Light Vehicles 4- MGs 5- RPGs 6- Troops	1- MANPADs 2- ATGMs 3- MGs 4- RPGs 5- Troops

MACHINE GUN EMPLOYMENT
Engagement Techniques

The term engagement techniques is not a reference to a specific doctrinal term but rather a general descriptive term to describe ways of using the machine gun to engage enemy targets. This section builds off the previous sections but is less structured since there are many different possible techniques for employing machine guns and multiple variations and applications of each technique. This section does not aim to cover every possible way you might use a machine gun to engage enemy forces. It only offers a few general suggestions and examples of common engagement techniques that can apply in many different situations. The previous section covered how to make machine gun fire safe and effective. This section discusses ways to use that effective fire to achieve different effects on the enemy in different situations.

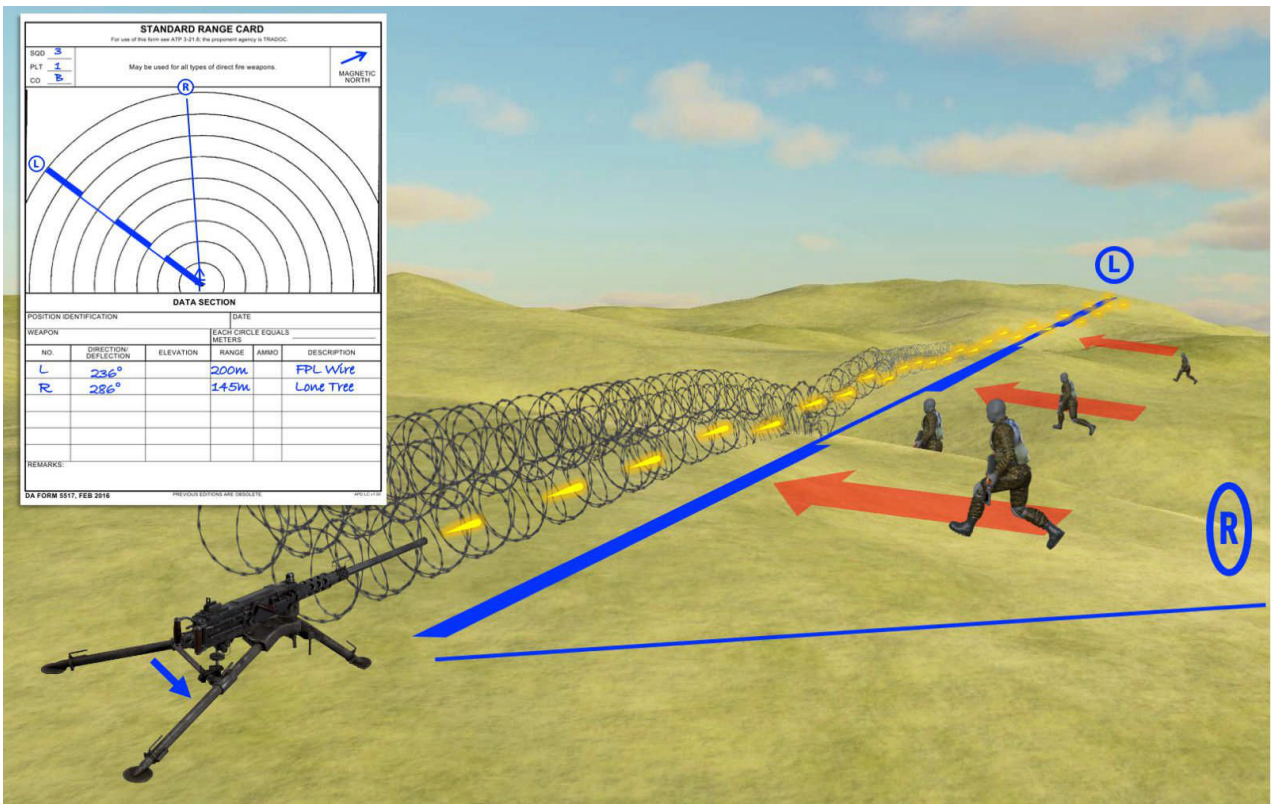
All of the techniques in this section may not apply to your specific mission requirements. You may never use some of them or you might end up using all of them. In most cases, you will most likely use combinations or variations of the techniques and modify them for your own purposes. Much like the section on tactical concepts, each technique in this section seeks to capitalize on one or more specific advantages offered by the machine gun's unique capabilities.

As with the rest of this book, this section does not focus on specific gunner marksmanship skills or techniques. Such techniques include firing the gun while traversing (moving the gun left and right), searching (changing the gun's elevation) and using a combination of traversing and searching to engage different shaped formations on the battlefield. Such techniques are important so they deserve mention here. You can find more specific guidance on gunner skills and techniques for actually firing the machine gun in most official machine gun manuals.

TECHNIQUES: FINAL PROTECTIVE LINE

General Overview

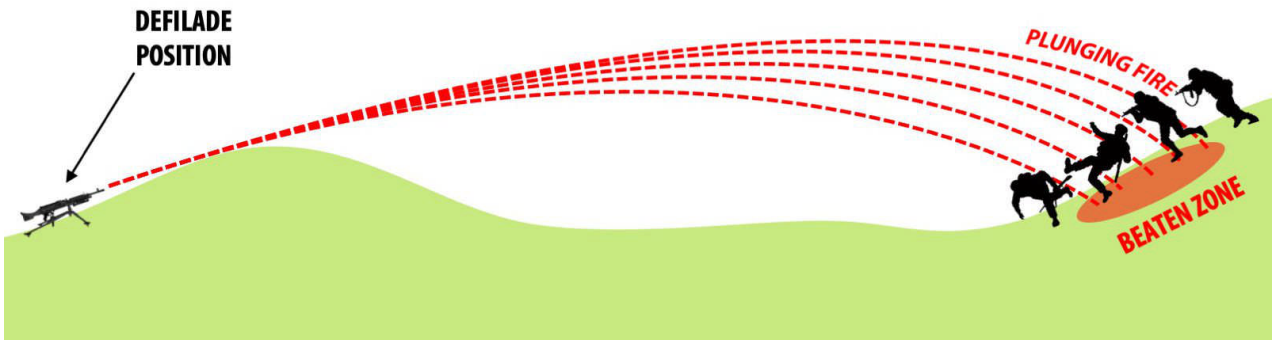
The final protective line (FPL) is a way to employ the machine gun in a last-ditch defensive effort against an enemy assault. Thankfully, there have not been too many recent instances of U.S. positions getting overrun by enemy assaults so there are relatively few cases when FPLs have been employed in modern combat. However, given the increasing likelihood of high-intensity conventional war it is important for infantry units to understand how to employ an FPL as part of a defensive plan. The FPL will be either the left or right limit of the gun's primary sector. In the example below, when the gunner traverses the gun all the way to the left (with the T&E attached) the gun will be pointing directly along the FPL. The FPL is designed to run in front of a defensive obstacle, most often triple-strand concertina wire (barbed wire). That way, as assaulting enemies encounter the obstacle and either become entangled or stop to cut the wire, they will be exposing themselves to enfilade fire from the machine gun. This makes it very difficult for enemies to breach your wire. The FPL is marked as a thicker line on the range card with breaks in the thickness of the line denoting dead space along the FPL. The FPL is usually integrated with other defensive measures such as mines, boobytraps and predesignated final protective fires (FPF) from artillery and/or mortars. While this is a common application of an FPL, you can also employ an FPL without wire or other obstacles as part of a patrol base or perimeter defense.



TECHNIQUES: DEFILADE FIRE

Basics of Defilade Fire

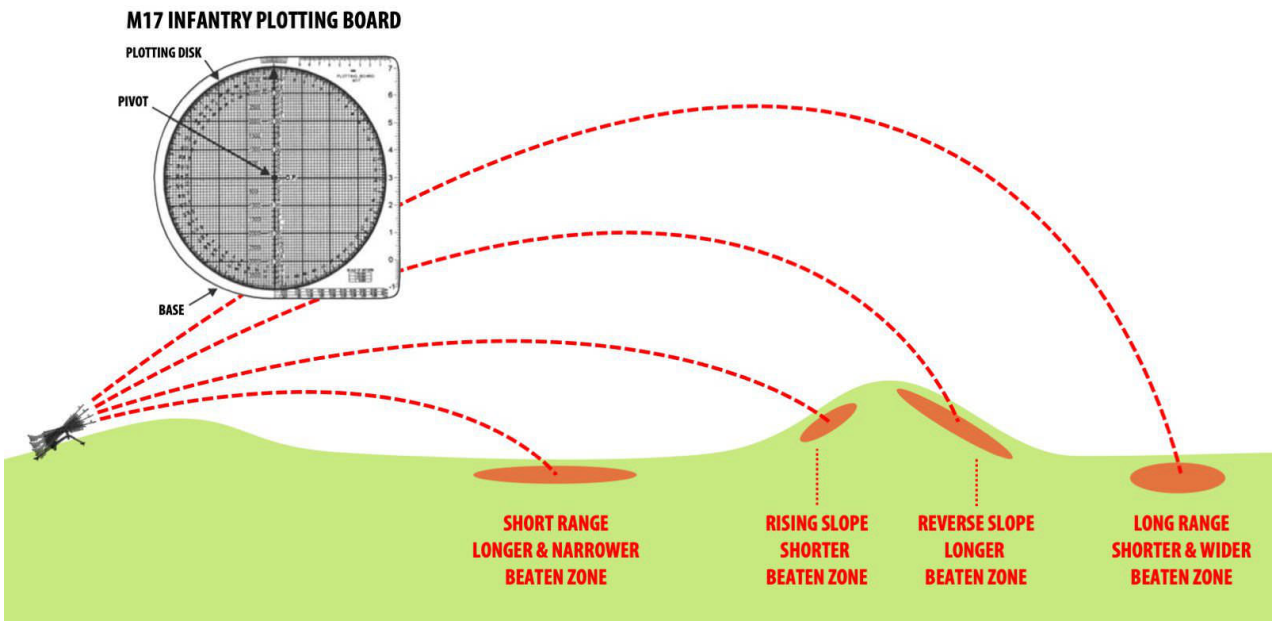
A defilade position is when terrain to your front totally blocks the enemy from seeing you. In simple terms you are down on lower ground, hidden behind a hill. Because machine gun fire, travels in an arc, it is possible to engage targets from behind a defilade position without those targets being able to see you. However, because you cannot see the targets yourself over the hill to your front, you will need to use your T&E and/or improvised techniques to predetermine settings for your gun to target a specific area and then use a spotter who can see the target to notify the gun team when the enemy enters that area. There are a number of ways to do this, some involving more complex indirect fire techniques in which you employ your machine gun much as you would a mortar using a map and plotting board. However, in a real-world scenario where using defilade fire is practical (mainly fixed defenses with a limited number of enemy avenues of approach) the simpler system you can use to get rounds on target the better. We will discuss some more practical applications of defilade fire later on.



TECHNIQUES: INDIRECT FIRE MODE

Basics of Indirect Fire

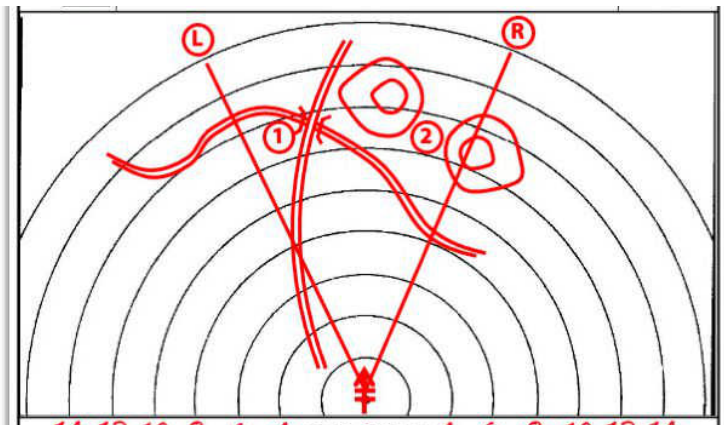
Following from the previous section, it is possible to employ the machine gun as an indirect fire weapon much like a mortar or artillery gun. This is generally not the preferred way to employ a machine gun since machine guns are more effective in the direct fire role and have limited range in indirect fire when compared with mortars. Indirect fire also takes practice which is not always possible if training ammunition is limited. Tactics and techniques for employing indirect fire are beyond the scope of this book and will be covered in future Special Tactics publications. However, for familiarization purposes it is useful to know that if the situation calls for it, it is possible to conduct fairly precise calculations to determine the width and length of the beaten zone and machine gun will produce when fired at specific high angles, based on the slope of the terrain in the target area. It is possible to then factor those beaten zones into more complex defensive plans and engagement areas. The diagram below gives an example of an M17 plotting board used to plot indirect fire, along with some examples of how various ranges and slopes of terrain affect the beaten zone when a machine gun is fired in indirect mode.



TECHNIQUES: PREDETERMINED FIRE

Principal Direction of Fire and Avenues of Approach

Using different combinations of the techniques and control measures discussed so far it is possible to make use of predetermined fire in various tactical situations. The FPL is one example of a predetermined fire. In defensive situations when employing an FPL is not possible or practical, you might choose to instead employ a Principal Direction of Fire (PDF). This is a predetermined gun setting or aim point that covers a key enemy avenue of approach like a road or a gap in obstacles or rough terrain. Another example is using indirect fire settings to target a bridge that the enemy must cross to reach your position, then using a spotter to give warning when the enemy is in the targeted area. As already mentioned, using improvised control measures like aiming stakes or the tree crotch technique can be faster ways to quickly lay down predetermined fire. Another technique involves using booby traps or other early-warning devices or sensors. Drawing from previous examples, if the enemy must either cross a bridge or walk through a narrow pass to reach your position, you might set up different color trip flares at each of these locations. If you see the green flare you will initiate predetermined fire on the bridge target but if you see the red flare you will initiate predetermined fire on the pass. Such predetermined fires might disrupt and confuse the enemy, delaying and disrupting his attack. These are just a few examples of predetermined fire applications. Predetermined fires take time and effort to prepare are generally less effective than more adaptive responses to the enemy, but they can be useful in certain situations.



POSITION IDENTIFICATION: Primary MG1 | DATE: 18 DEC 2021

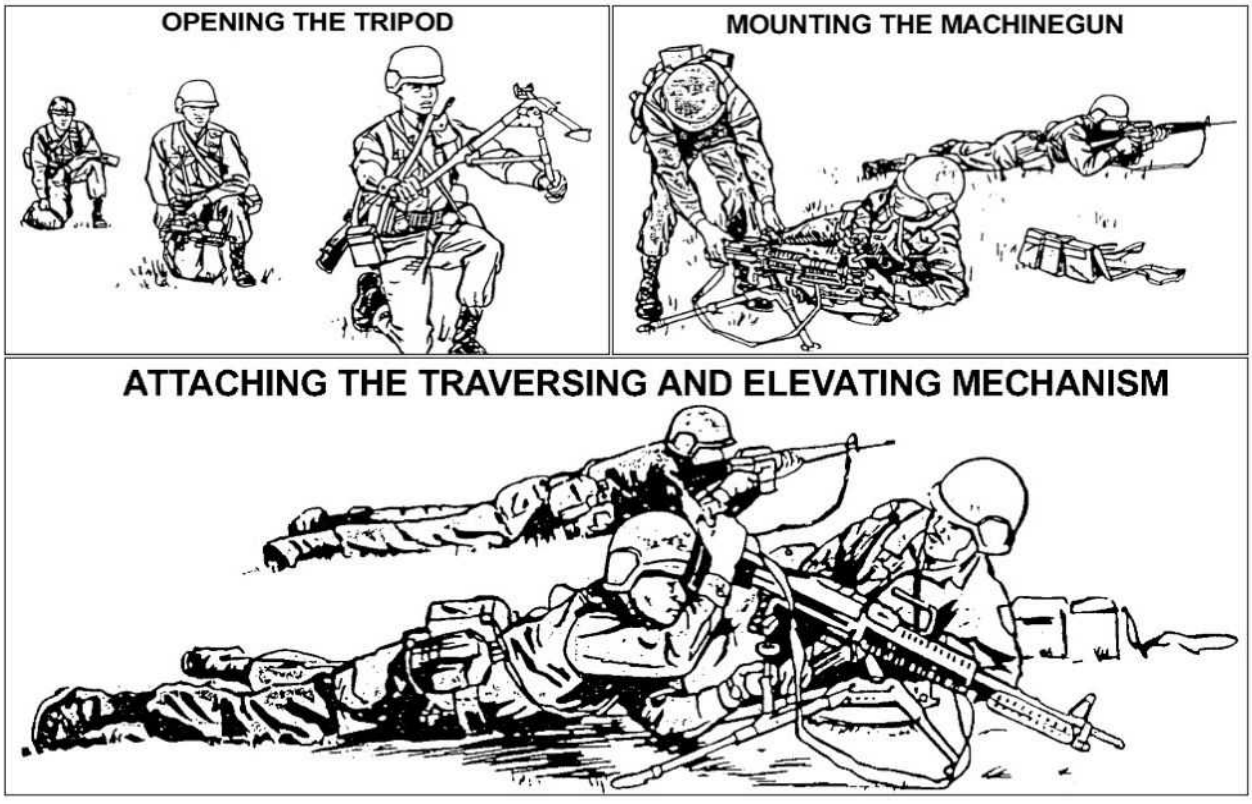
WEAPON: M240B | EACH CIRCLE EQUALS METERS: 200

NO.	DIRECTION/ DEFLECTION	ELEVATION	RANGE	AMMO	DESCRIPTION
L	265°		200m		Lone Tree
R	315°		145m		Boulder
1	L 212	+27	1280m		Bridge (red)
2	R 194	+35	1420m		Pass (green)

TECHNIQUES: CREW DRILLS

Placing the Gun into Action and Changing Barrels

Most of the employment techniques discussed so far have involved operating the gun from a fixed position. Crew drills involve placing the gun into action while maneuvering. Crew drills are more important and more difficult the bigger the weapon system you are operating. A crew of two troopers can generally place a medium machine gun into action whereas a heavy machine gun ideally employs a crew of three troopers. The most practical crew drills to focus on are placing the gun into action on a bipod or tripod and changing the barrel quickly under fire. In general, if you are performing a crew drill, it means you are under time constraints. Therefore, the quickest way to get the gun into action is generally the best. For the medium machine gun this often means beginning to engage the enemy from the prone position on the bipod with a starter belt while the assistant gunner attaches the rest of the ammo belt. However, to effectively employ a heavy machine gun you will generally need to mount it on a tripod which calls for a more involved drill. The key to performing effective crew drills in combat is extensive training and experimentation in peacetime. We will discuss some crew drill training techniques in a later section. Your focus should be on finding the most effective and simple techniques to get the gun into action quickly and deliver accurate and effective fire on the enemy. The diagram below is taken from a U.S. Army manual and shows troops placing a medium machine gun into action.

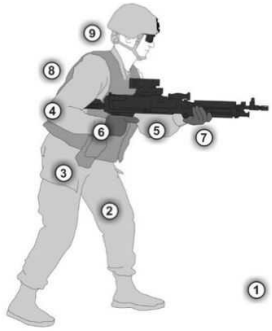


TECHNIQUES: MACHINE GUN IN THE ASSAULT

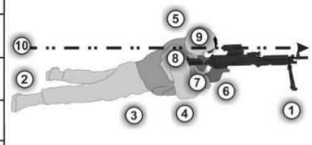
Upright Fire and Bipod Fire

More deliberate infantry tactics often recommend placing the machine gun in a stationary support position. However, more aggressive tactics largely pioneered by the German Army starting in World War I advocate bringing the machine gun along with the assault. The U.S. military has adopted similar aggressive tactics and effectively employed the machine gun as an assault weapon in many historical engagements. One of the key advantages of employing a machine gun in the assault is that it offers additional firepower to deal with unexpected enemy forces encountered during the assault. Given the unpredictable nature of warfare, it is likely that an assault element will stumble upon an enemy bunker, machinegun position or approaching reinforcements that the support position is unable to engage. The assault machine gun can quickly engage, suppress and/or destroy these forces to ensure the assault maintains momentum. Bringing a machine gun in the assault is also useful for repelling enemy counterattacks after seizing the objective. There are several methods of firing a machine gun in the assault including from the hip or from the shoulder. These specific techniques are beyond the scope of this book. However, it is worth pointing out that some people think that using a machine gun in the assault means you have to shoot it from an upright position. In most cases, it is fairly easy to quickly drop to the prone position and fire the machine gun from the bipod in the assault. Firing from the bipod is generally much more effective and in the prone position you will be much less exposed to enemy fire. We therefore recommend that you should only fire from an upright position if firing from the prone is not possible. The diagrams below are taken from a U.S. Army Manual and demonstrate standing and prone firing positions with a machine gun.

1	Support:	Unsupported
2	Leg Position:	Standing, firm, feet shoulder-width apart.
3	Stance / Center of Gravity:	Aggressive lean forward toward the target.
4	Firing Elbow:	Tucked toward the shooter's side with the emphasis on the stability of the weapon.
5	Nonfiring Elbow:	Slightly outward.
6	Firing Hand:	Grasping pistol grip, finger off the trigger until ready to fire.
7	Nonfiring Hand:	Extended forward, placed underneath the receiver assembly with the bipod extended.
8	Buttstock	Tucked underneath the arm.
9	Firer-Gun Angle:	The body is approximately 45 degrees to the gun-target line.



1	Support:	Supported with bipod.
2	Leg Position:	Spread with heels flat against the ground or the firing side leg bent at the knee to relieve pressure.
3	Stance / Center of Gravity:	Prone position maximizes the Soldier's frame against the ground for maximum stability.
4	Firing Elbow:	Used to provide stability to the weapon.
5	Nonfiring Elbow:	Used to provide stability to the weapon.
6	Firing Hand:	Grasping pistol grip, finger off the trigger until ready to fire.
7	Nonfiring Hand:	Firm grasp of the stock weld.
8	Buttstock	Mid-point of shoulder to absorb recoil impulse.
9	Stock Weld:	Firm stock weld.
10	Firer-Gun Angle:	The body is nearly in-line with the gun-target line.



MACHINE GUN BATTLECRAFT
Maximizing Effects of the Gun

This chapter discusses how to incorporate machine guns into infantry squad and platoon-level battlecraft. Special Tactics uses the term "battlecraft" to describe a new way of thinking about infantry combat and the real-world tactics, techniques and skills required to win on the battlefield. Battlecraft was originally a British term used during the World War II era which we chose to revive because the term "craft" suggests a deeper, more complex understanding or artform beyond a rigid drill or process. Battle drills, an understanding of them and how to apply them forms one component of battlecraft. Immediate action response training, fire and maneuver, tactical use of terrain and close combat tactics also are component parts of battlecraft. We cover battlecraft in more detail in our infantry rural combat books.

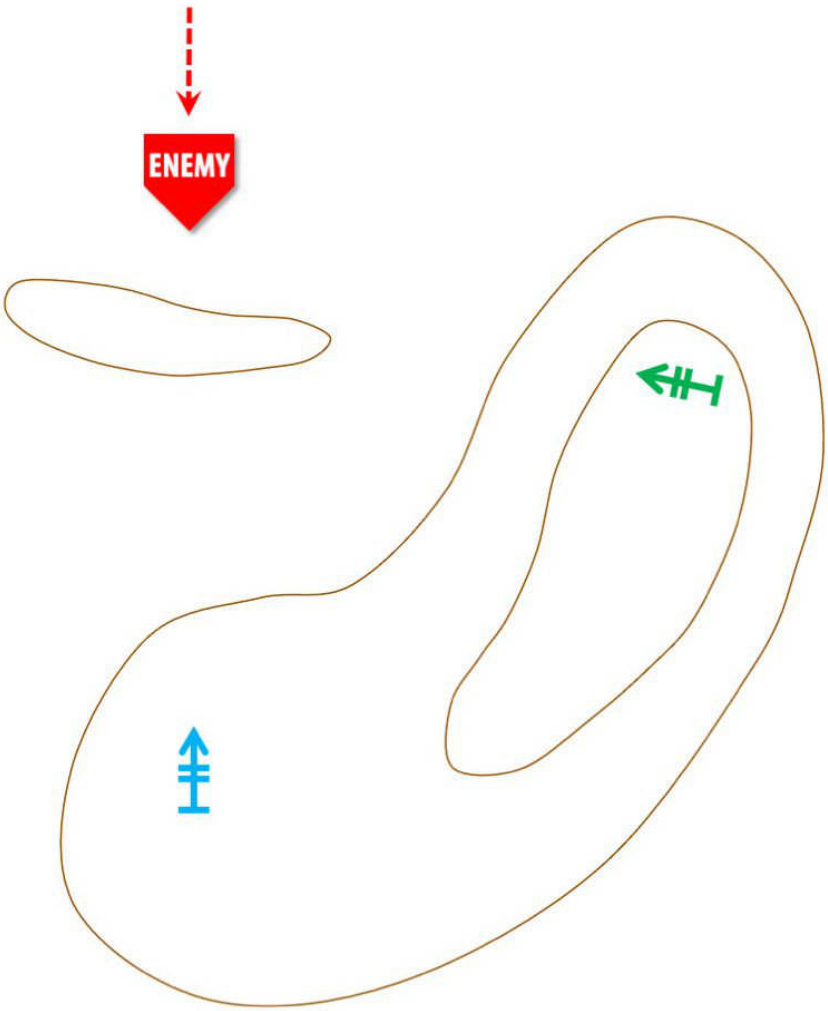
This section does not offer a comprehensive discussion of how to conduct battlecraft at the squad or platoon level but rather specifically focuses on how machine guns fit in to the larger discipline of battlecraft. Each of the techniques discussed in this section takes advantage of a particular strength or capability offered by the machine gun. As already discussed, truly effective machine gun employment calls for taking maximum advantage of the gun's strengths and leveraging those strengths against enemy weaknesses. This section offers just a few techniques for doing this. However, as with battle drills, these techniques can serve as building blocks or starting points for more flexible, creative maneuvers based on specific tactical situations.

In most of the following techniques, regular infantry teams, squads or platoons are not depicted. The instruction focuses only on the positioning, maneuver, and employment of machine gun teams. This does not mean these techniques are intended to be employed only with machine guns and no additional infantry support. The opposite is true. All of the following techniques should be incorporated into squad or platoon-level infantry maneuvers. The only reason we have chosen to demonstrate most of the techniques with gun teams only is to make the explanations simpler and easier to follow.

BATTLECRAFT: SEQUENTIAL FIRE TRAP

STEP 1: Set Up the Trap with Your Machine Guns

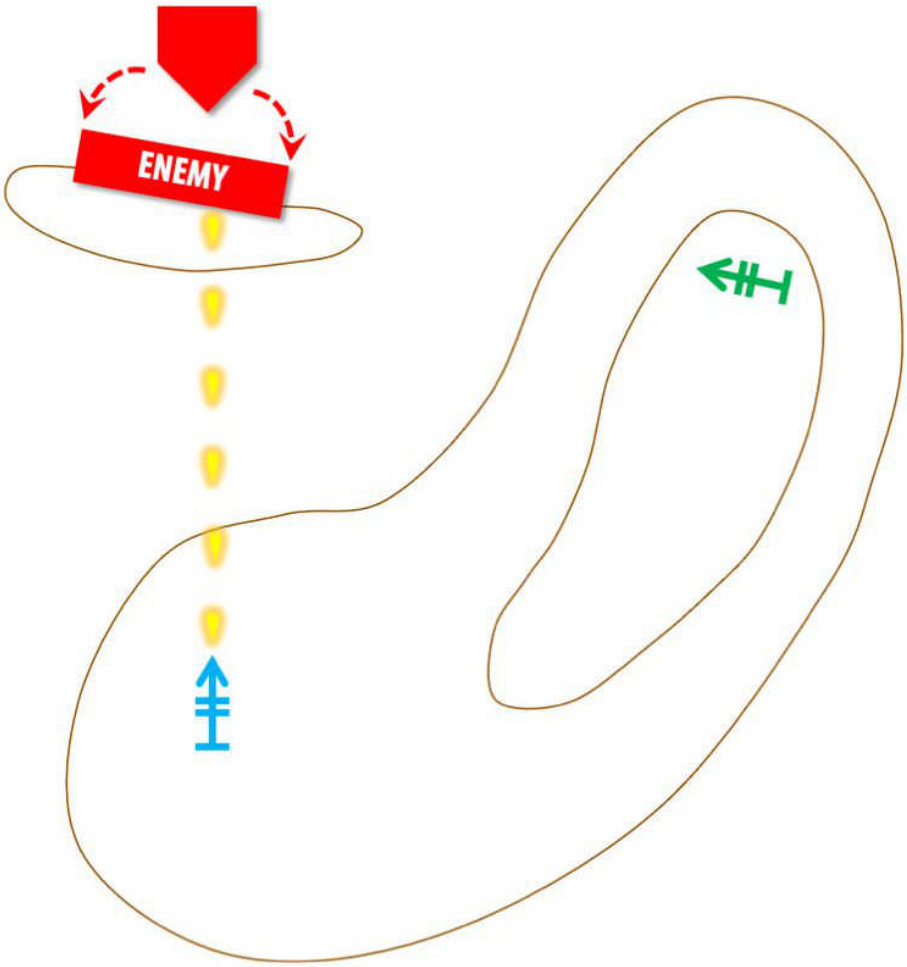
A sequential fire trap calls for the use of two elements, at least one of which is a machine gun. The idea behind the tactic is to use the first element or gun to draw or force the enemy into a position where they are more vulnerable to the machine gun. We briefly discussed this tactic earlier in the section on sequential fire. The example below offers one example of how to set up and execute a sequential fire trap but there are many ways to apply the same concept in different situations and terrain. In the example below you identify an obvious piece of terrain (the small, thin hill in the center of the diagram) that provides good cover and concealment from the machine gun position marked in blue. You then position your second gun (green) where it can achieve enfilade fire on an enemy taking cover behind the small hill and wait while the enemy approaches.



BATTLECRAFT: SEQUENTIAL FIRE TRAP

STEP 2: Open Fire with the First Gun Only

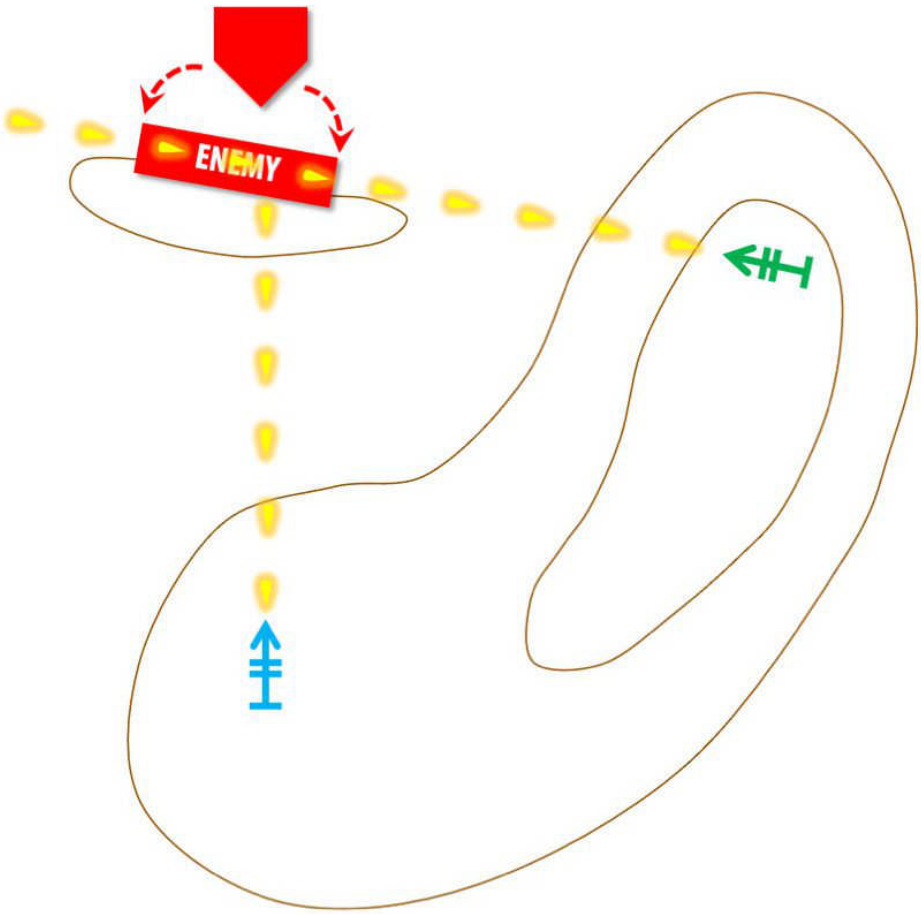
Before the enemy reaches the small hill, open fire with your first machine gun (marked in blue). It is important that you open fire before the enemy reaches the small hill since the objective is to force the enemy to take cover, on-line behind the hill. Since the hill provides good cover, it is almost certain that the enemy will take advantage of it and it would not make much sense for the enemy to choose a different course of action if they are taking fire. The second gun (green) should not open fire right away but instead hold fire until the enemy are all on-line behind the hill taking cover from the first gun.



BATTLECRAFT: SEQUENTIAL FIRE TRAP

STEP 3: Achieve Enfilade Fire with the Second Gun

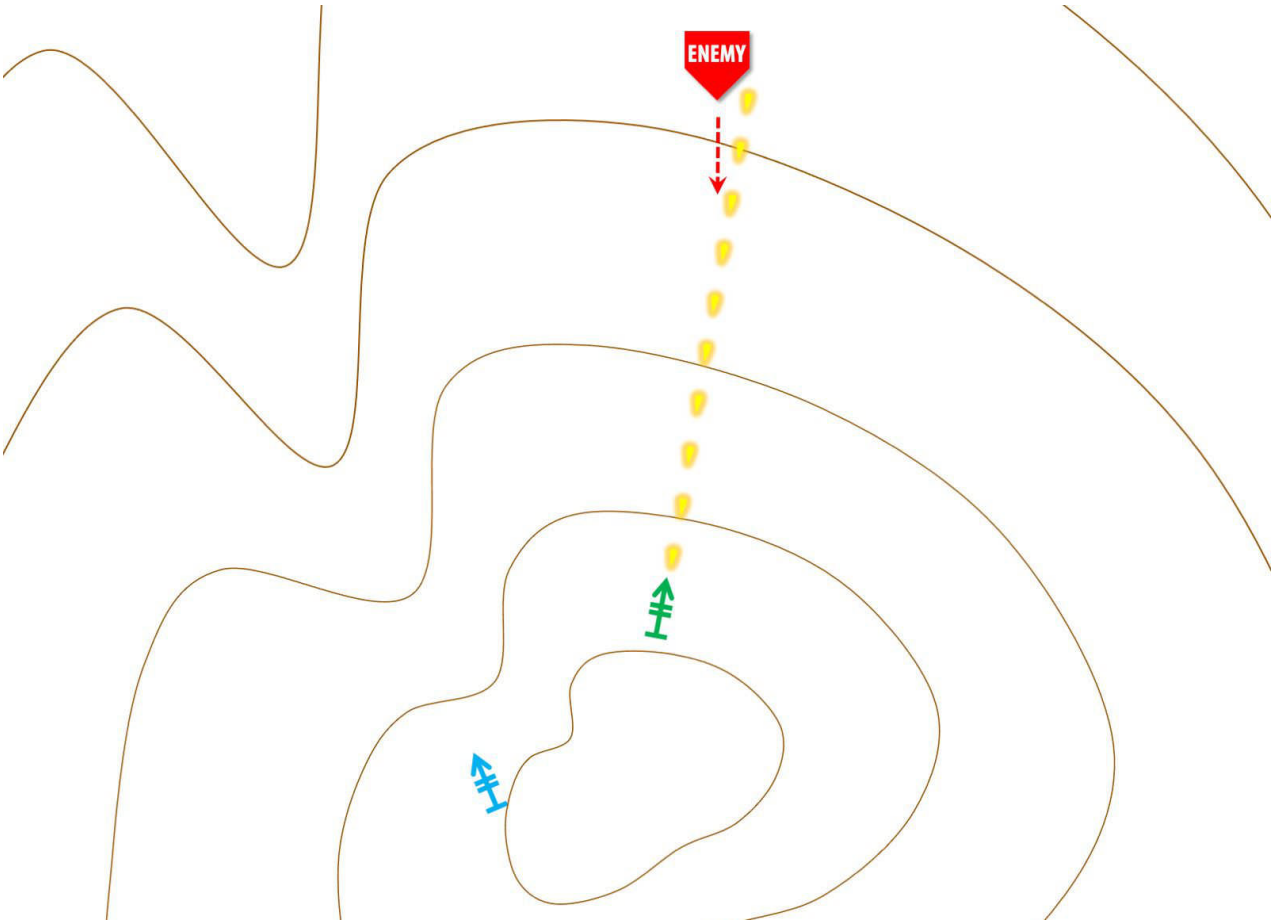
Once the enemy is tightly packed on-line behind the hill to avoid the fire of the first (blue) gun, open fire with the second gun. Your fire from the second gun will be extremely effective because it will catch the enemy in his exposed flank and the bullets will rip through the long axis of his formation (enfilade fire). If you opened fire with both guns right away the enemy might not have fully exposed himself to the trap. This sequential fire example draws the enemy into enfilade fire but it is possible to use similar sequential fire traps to draw the enemy into plunging fire, a tactical L (interlocking fire with two guns) or any other position of vulnerability. The key concept of the technique is to use the initial fire from the first element to set up more effective fire for the gun. Once again, the first element may or may not be another machine gun but the second element to open fire should ideally be a machine gun.



BATTLECRAFT: TERRAIN OR OBSTACLE TRAP

STEP 1: Set Up One Gun to Cover Canalizing Terrain

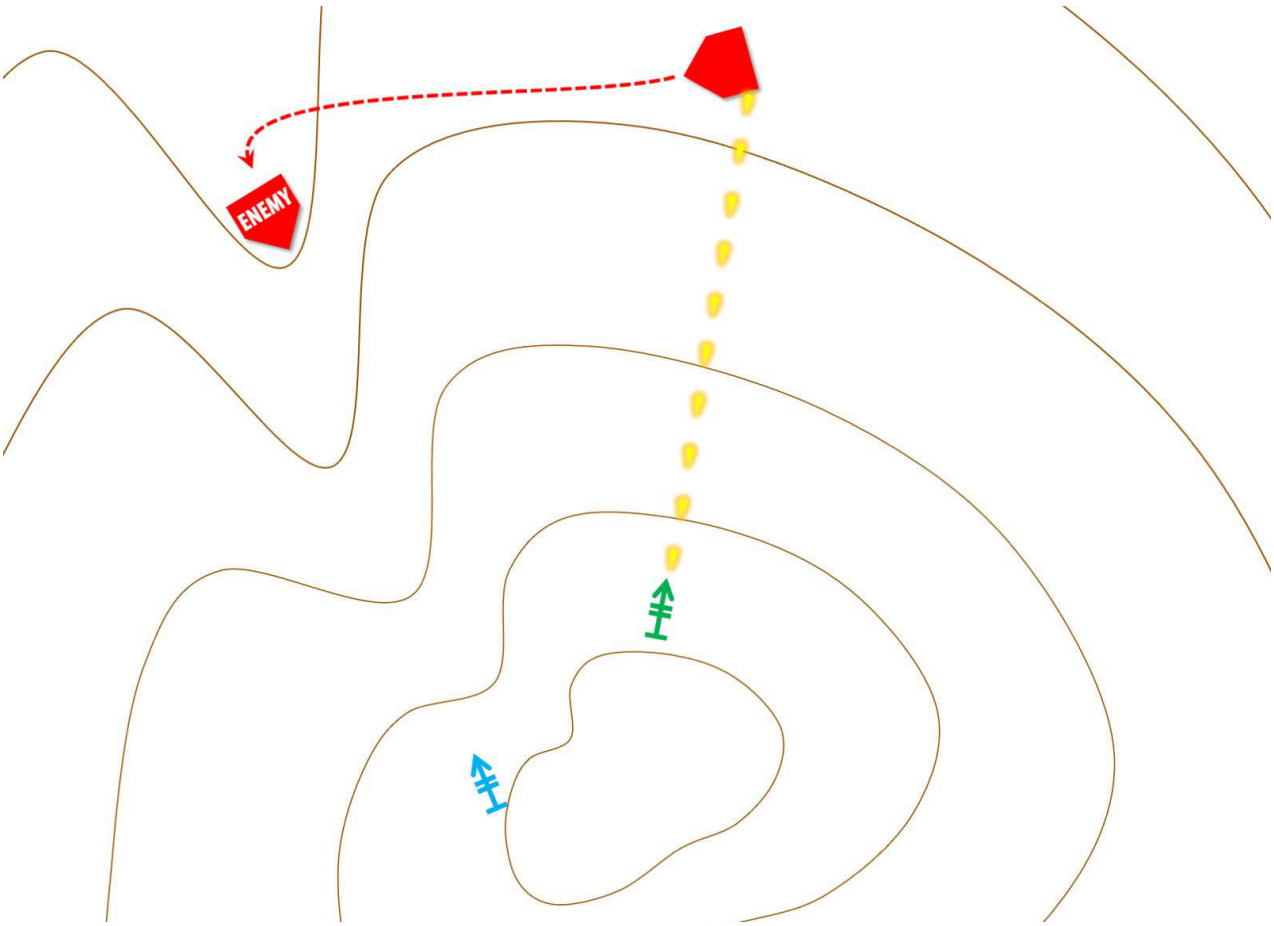
Another type of trap draws the enemy into your machine gun fire using the terrain or obstacles. In the example below, you set up a defensive position on the hilltop near the bottom of the diagram. There is a draw (dip in the terrain) on the left side of the diagram that offers a good covered and concealed approach to the hilltop. When the enemy starts moving up the hill you engage with your first gun. The second gun holds fire in position to cover the draw which is terrain that will "canalize" the enemy or force him to bunch up in a narrow formation, much like water running through a narrow pass or gap.



BATTLECRAFT: TERRAIN OR OBSTACLE TRAP

STEP 2: Draw the Enemy into Canalizing Terrain

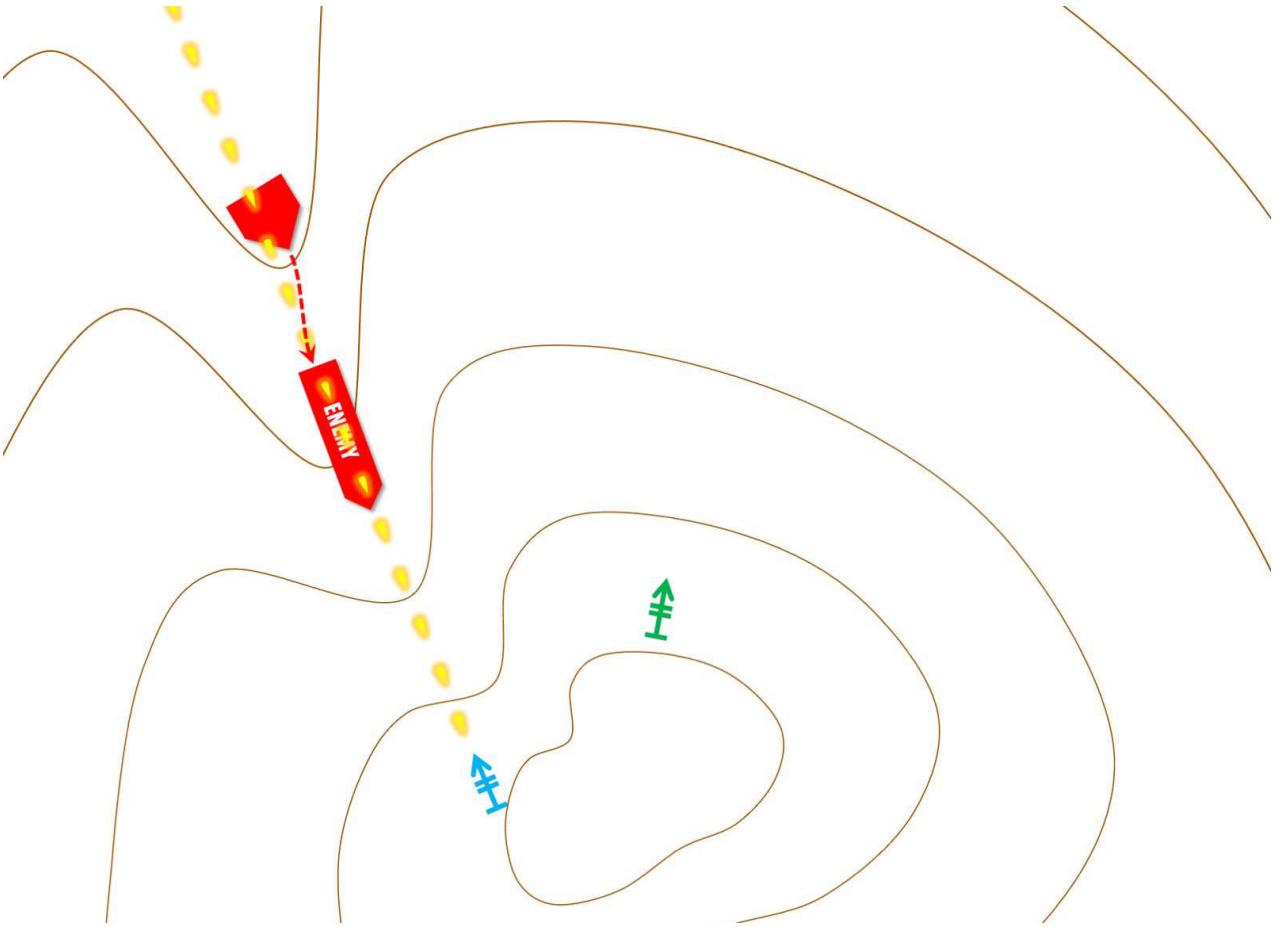
In order to avoid fire from the first gun, the enemy will move laterally to take advantage of the cover and concealed approach offered by the draw. Safe from the first gun's fire, the enemy will likely try to advance on your position through the draw. In this example, you are actually using both a sequential fire trap and a terrain trap at the same time. However, this does not always need to be the case. You do not need to use sequential fire to set and execute a terrain trap. You can simply set up the defense or obstacles in a way that offers an obviously safer avenue of approach to lure the enemy. It is also important to remember that smart or experienced enemies might anticipate your trap so it is important to set the trap with the enemy's perspective in mind.



BATTLECRAFT: TERRAIN OR OBSTACLE TRAP

STEP 3: Engage the Enemy in the Canalizing Terrain

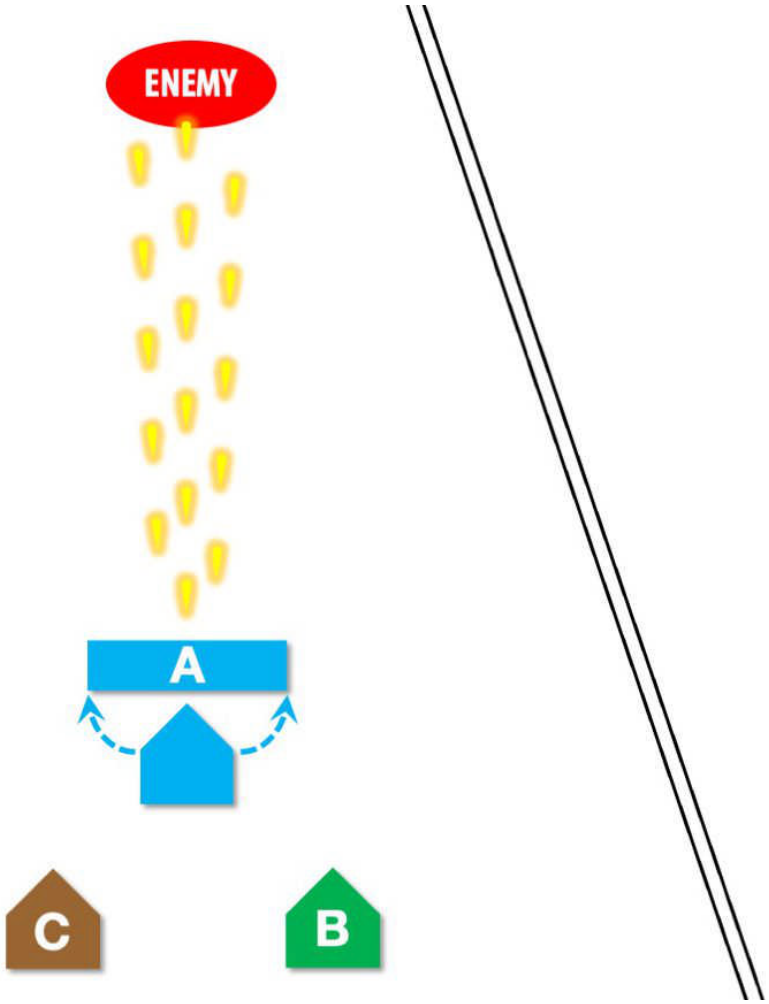
Once the enemy is advancing up the draw and canalizing himself, he will be more vulnerable to your fire. Also, once you open fire, if the terrain is constricting it will be more difficult for the enemy to escape the trap and get out of the way of your fire. Once again, this example uses terrain only but it is also possible to use obstacles to achieve the same effects. When preparing your defensive position, you can emplace obstacles liked triple-strand concertina (barbed) wire that canalize the enemy along a predictable avenue of approach. The enemy will most likely try to avoid obstacles like barbed wire and take the easier path, unknowingly walking into your machine gun's line of fire. However, as with terrain, a smart enemy might anticipate the trap and attempt to breach through your obstacles instead of taking the easier path.



BATTLECRAFT: ROAD TRAP

STEP 1: Lead Team Makes Contact and Returns Fire

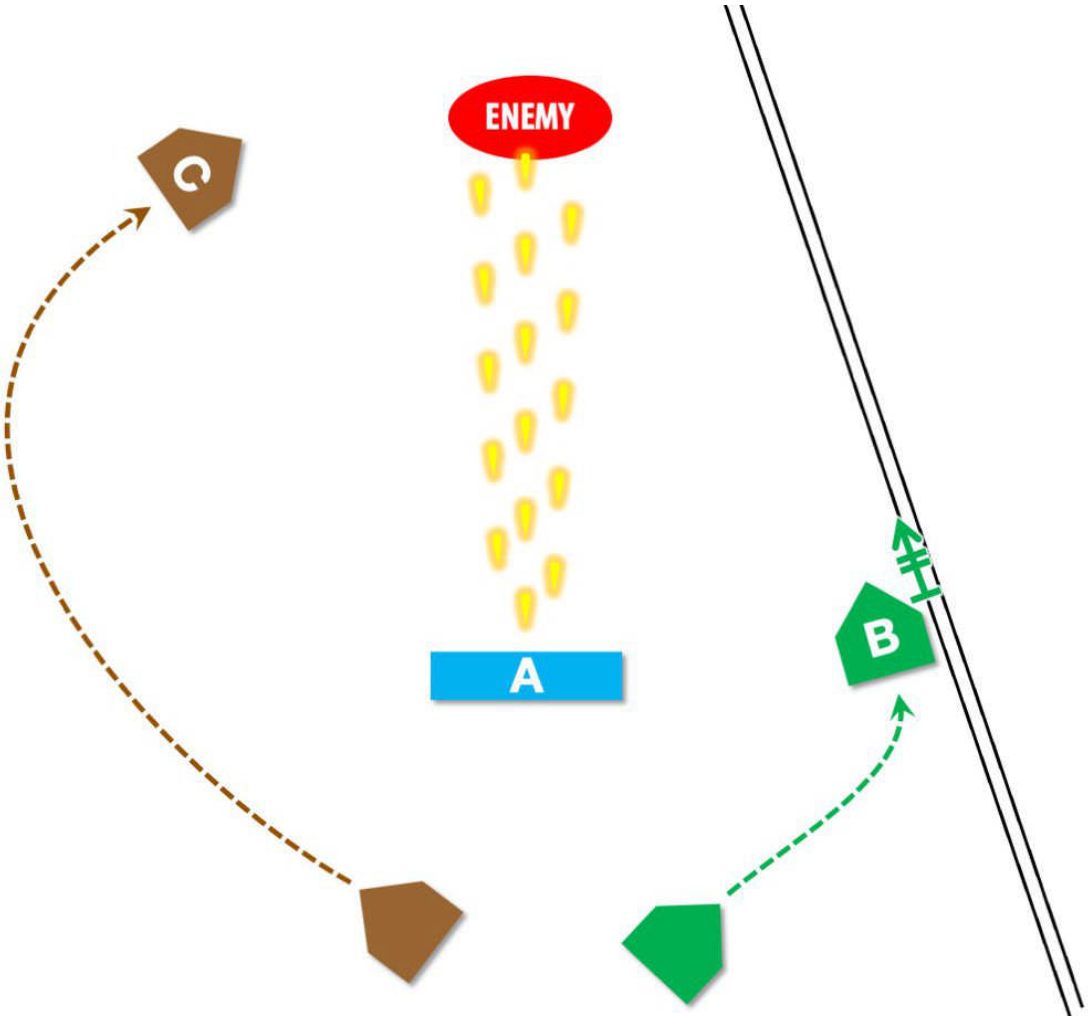
You can use a road or any LDA (Linear Danger Area) as a trap to maximize the effects of your machine gun's capability. The key is luring or forcing the enemy to cross the road through your line of fire. One of the best examples of this is taken from our Squad Level Infantry Rural Combat book and employs three elements and a machine gun in a "hammer and anvil" maneuver. The maneuver begins with the lead element coming on line and laying down suppressive fire.



BATTLECRAFT: ROAD TRAP

STEP 2: B Team Sets Up MG on the Road as C Team Flanks

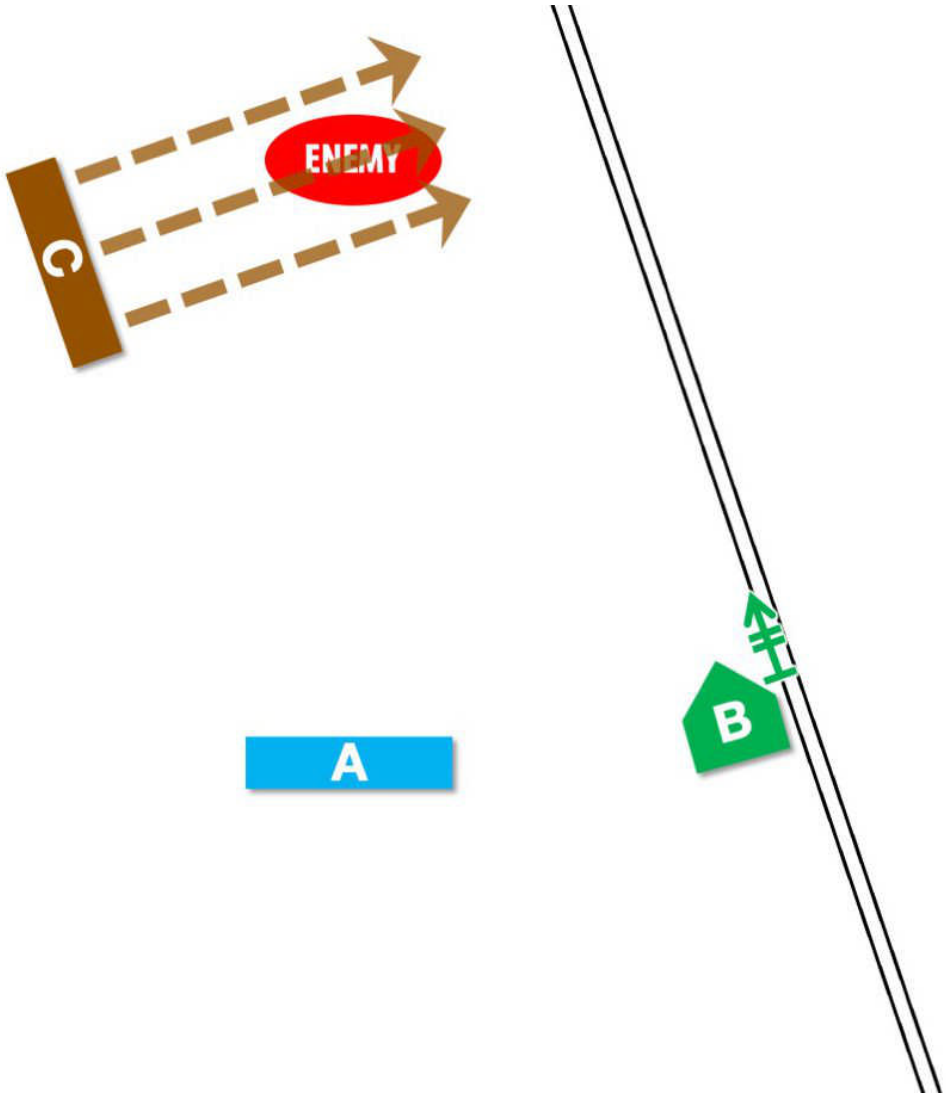
Once the lead time makes contact and begins suppressing the enemy, the squad leader decides to use the road to the right as an "anvil" against which to drive the enemy force. The squad leader sends B Team and at least one medium machine gun to establish a Principal Direction of Fire (PDF) along the road. At the same time, C Team will flank around to the right in a standard flanking maneuver against the enemy position.



BATTLECRAFT: ROAD TRAP

STEP 3: C Team Assaults Through the Objective

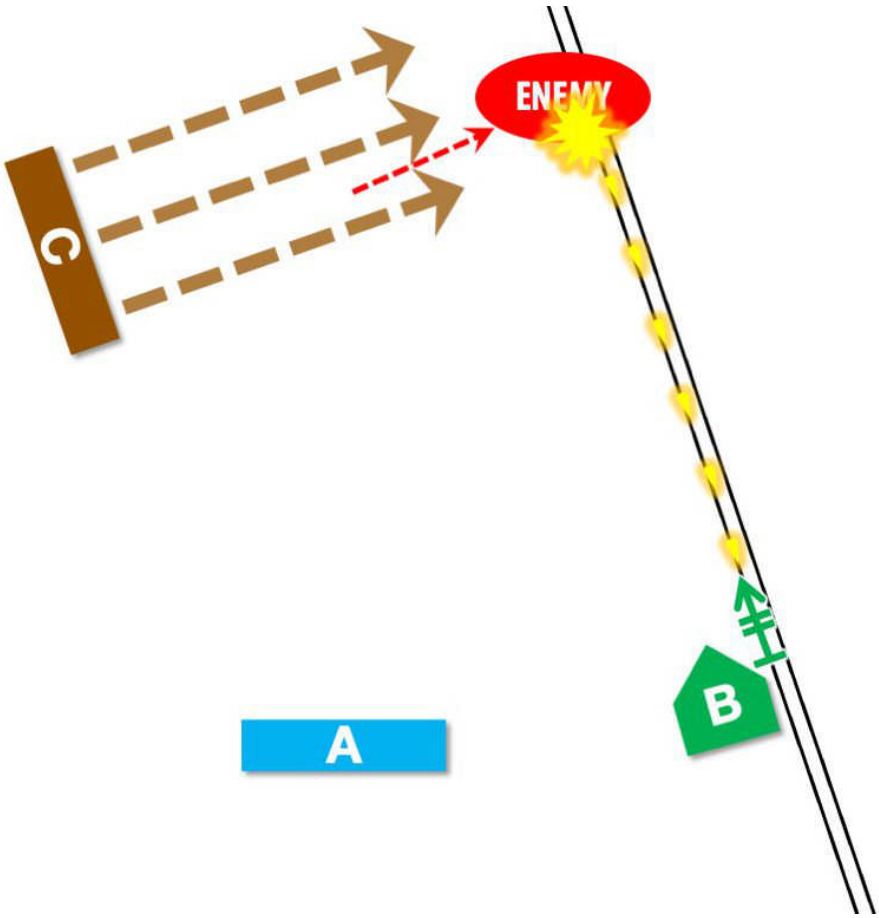
Once in the assault position, C Team will assault through the objective just as in a standard flanking battle drill. A Team will cease fire, shift fire or lift fire to ensure they do not shoot members of the assault team. B Team and the machine gun will maintain coverage of the road and remain concealed as much as possible.



BATTLECRAFT: ROAD TRAP

STEP 4: C Team and MG Engage Retreating Enemies

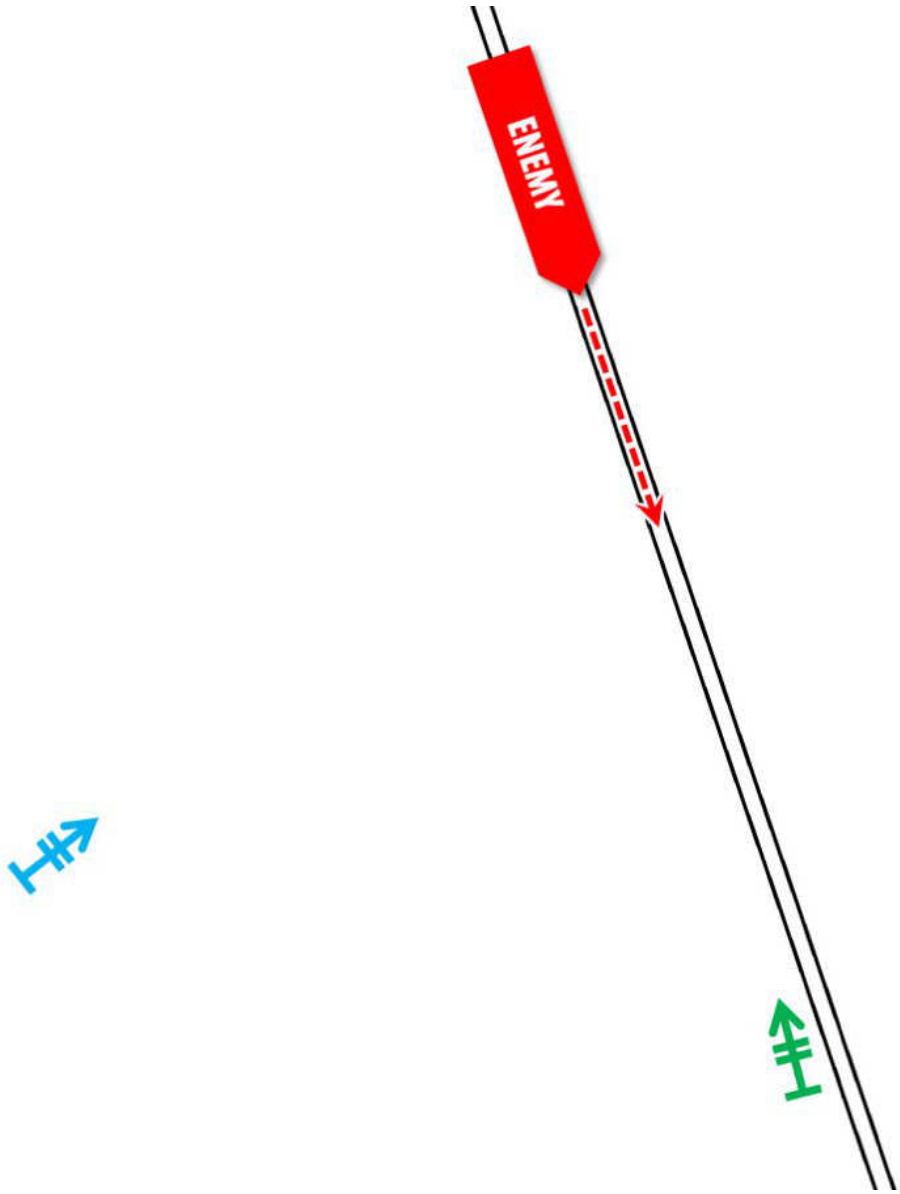
In a standard suppress and flank battle drill, unless the enemy is completely suppressed by the supporting element, there is nothing to stop the enemy from executing a break contact drill and bounding back, away from the assault element. In the example below, in order to fall back the enemy needs to cross a road. That road is covered by B Team and a medium machine gun. So, when the enemy falls back and exposes himself crossing the road, he will be hit by your machine gun bullets. The enemy will be especially vulnerable when crossing the road. If enemy troops are wounded and fall in the road it will create additional stress for the rest of the element since they will have to expose themselves to evacuate the casualties. If the enemy decides not to cross the road because of the machine gun, they will be fixed in place and vulnerable to C Team's assault. This is just one example of how you can drive the enemy into a road trap covered by a machine gun.



BATTLECRAFT: ENFILADE FIRE DOWN A ROAD

STEP 1: Set Up the Machine Gun Close to the Road

When employing a machine gun against an enemy force moving down a road, the closer you can position the machine gun to the road the more you will achieve enfilade fire. However, if the gun is too close to the road or on the road itself, it will be easy to spot by enemy forces. In the example below, you also emplace another element (in this case a second machine gun) at a different angle to support the first gun.



BATTLECRAFT: ENFILADE FIRE DOWN A ROAD

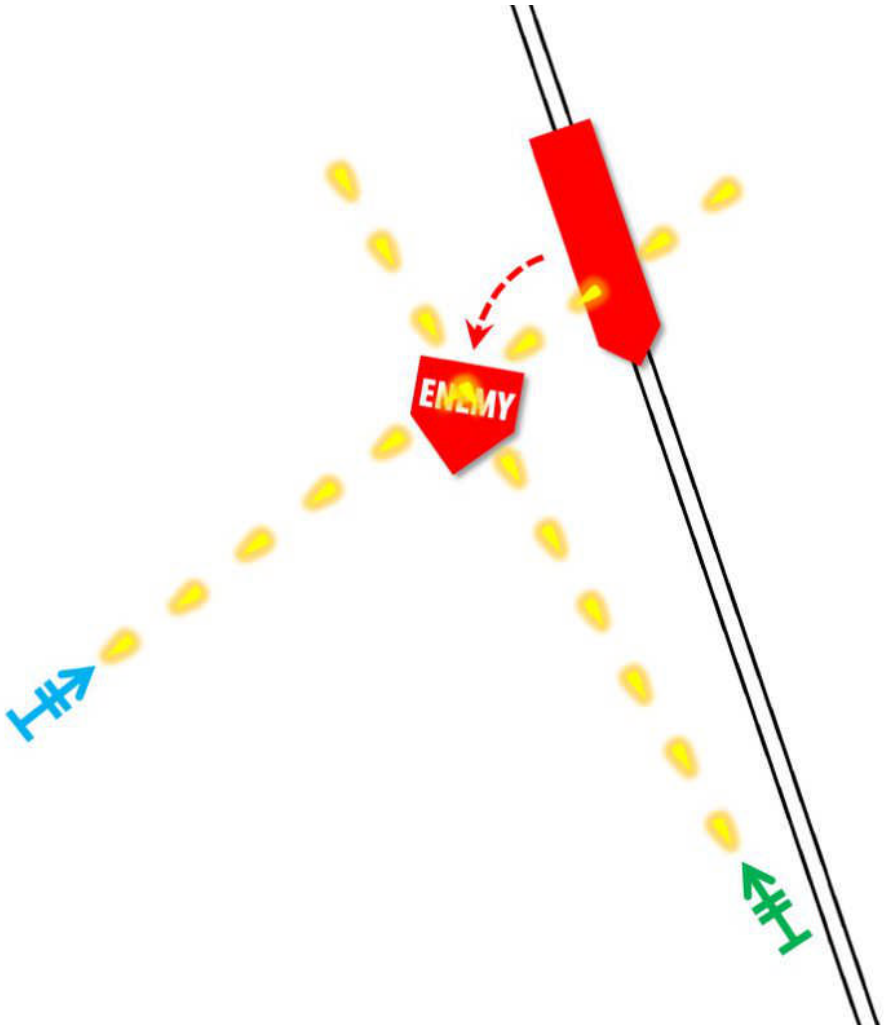
STEP 2: Open Fire with the First Gun

As you open fire with the first gun, you are trying to eliminate the maximum number of enemy troops as quickly as possible. Unlike in other maneuvers where waiting gave you an advantage, in this example the enemy is most vulnerable in the early seconds of the engagement when he is moving in a column or file down the road. Therefore it might be appropriate to engage with a high rate of fire during the beginning of the engagement.

BATTLECRAFT: ENFILADE FIRE DOWN A ROAD

STEP 3: Support with the Second Gun or Element

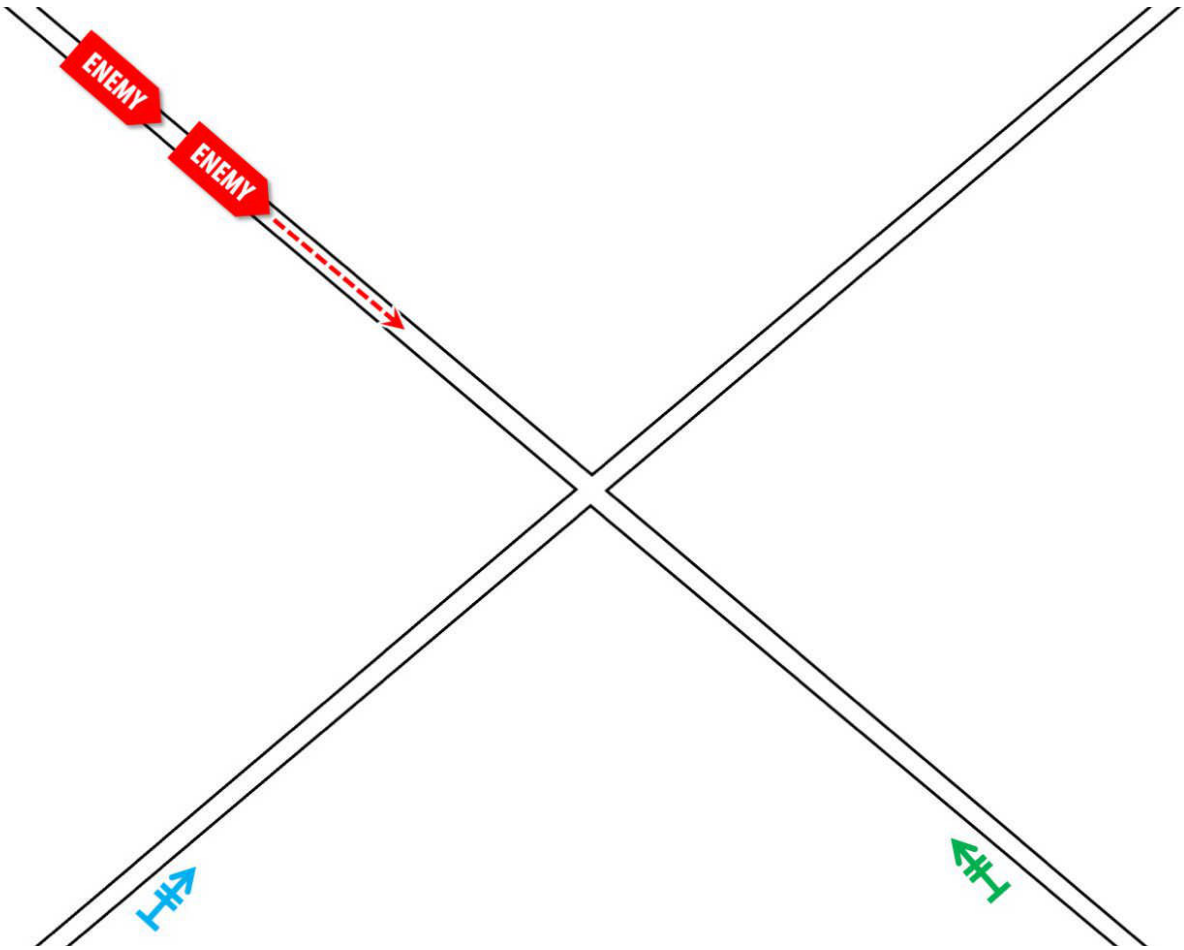
The enemy will not remain in the line of fire on the road for long and will likely move off the road in one direction or another. If the enemy is aggressive, he will probably move off the road on the same side as your gun in an effort to flank you. Because your gun is close to the road it is vulnerable to being flanked from the side away from the road. By positioning a second element or gun to fire on the enemy as he begins to flank around, you can fix the enemy in a tactical-L, giving both elements a better chance of either winning the engagement or breaking contact safely. If the enemy is employing flankers to either side of the road for security, this second element is also in a good position to engage the flankers. If the enemy decides to move off the road in the opposite direction, you can still open fire with both elements, driving the enemy away and preventing him from using the road.



BATTLECRAFT: ENFILADE FIRE AND INTERSECTION TRAP

STEP 1: Set Up a Machine Gun on Each Road

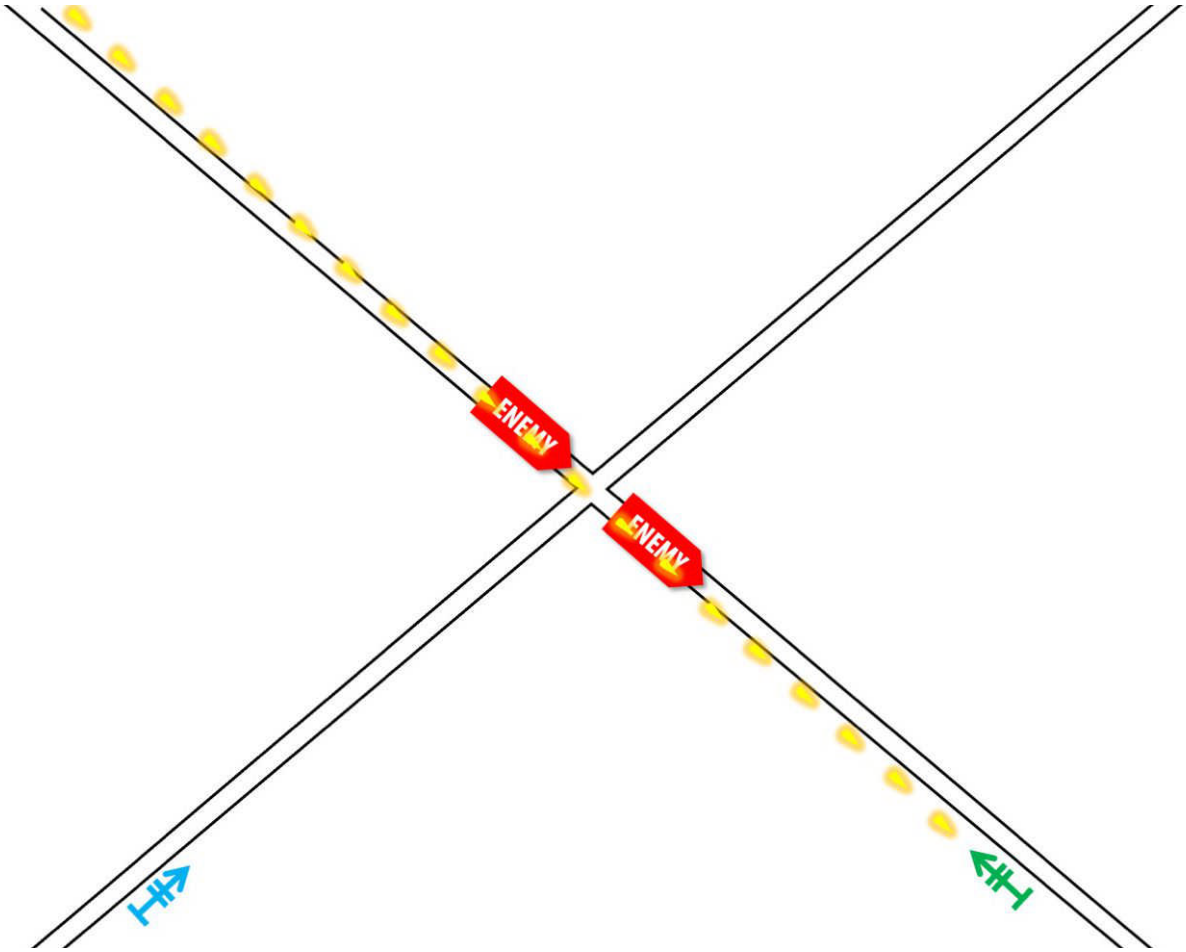
If you are able to set up your machine guns at an intersection, you can use a combination of the previous two techniques. As we will see, this technique can be particularly effective against enemy forces moving in a column with multiple elements for added security. Begin by setting up both guns facing the intersection on separate roads. Ideally, the two guns should not be separated by a road. This will allow them to break contact or be mutually supporting without having to cross a road. The enemy will approach down one of the two roads towards the intersection. Wait to open fire until the enemy reaches or has begun to cross the intersection.



BATTLECRAFT: ENFILADE FIRE AND INTERSECTION TRAP

STEP 2: Achieve Enfilade Fire on the Enemy Column

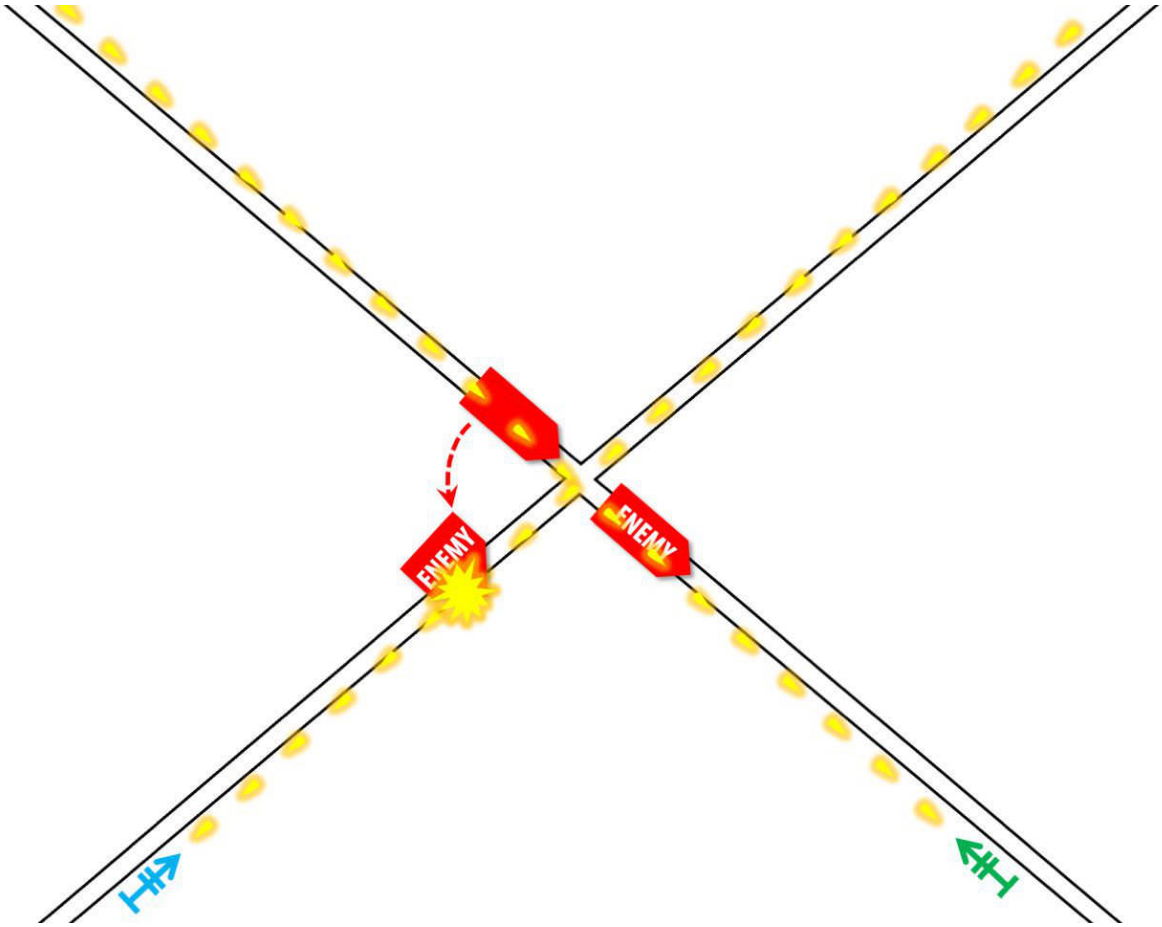
When the enemy reaches the intersection, open fire with the gun that can achieve enfilade fire on the advancing enemy column. There are different advantages to opening fire at different points as the enemy is crossing the intersection. If the enemy is moving in multiple columns, it can be effective to open fire when only the first column has crossed the intersection. As with employing enfilade fire down a single road, try to cause as much damage as possible to the enemy force early in the engagement while he is most exposed on the road.



BATTLECRAFT: ENFILADE FIRE AND INTERSECTION TRAP

STEP 3: Open Fire with the Second Machine Gun

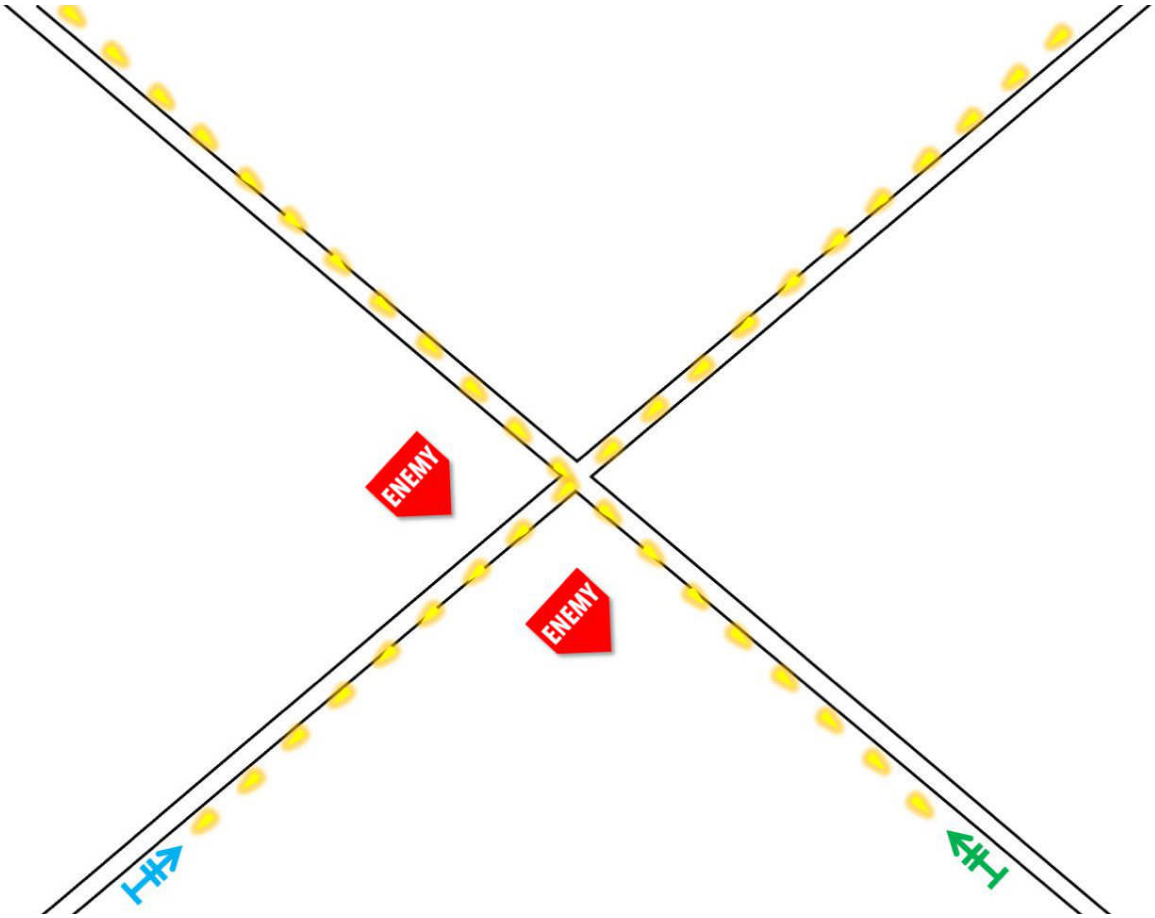
When the enemy column comes under fire, the lead element will likely absorb most of the damage and will probably attempt to get off the road, come on-line and return fire. The rear element may try to flank or at least move forward to provide help. However, in order to do this the second element will have to cross the road covered by the second gun (marked in blue). Once again, there are different advantages to opening fire at different times. One technique is to execute the same "road trap" covered earlier and engage the second element as it attempts to cross the road.



BATTLECRAFT: ENFILADE FIRE AND INTERSECTION TRAP

STEP 4: Trap the Enemy Elements on Opposite Sides

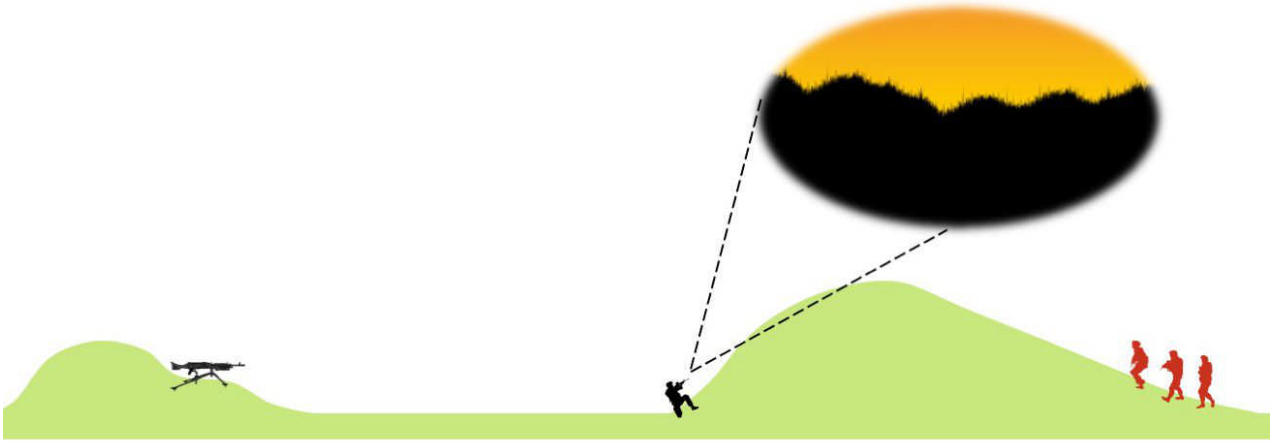
In some situations, it might be possible to trap enemy elements on opposite sides of the road by laying down heavy fire with the gun marked in blue. The lead element will not be able to pull back without crossing a road covered by machine gun fire and the rear element will not be able to advance past the road to help the lead element. This can be very disruptive and demoralizing for the enemy force and could make it easier for you to win the engagement and destroy the enemy. If the enemy does decide to cross the road under fire he will likely suffer more casualties. In the image below, both guns are firing directly down the roads to illustrate the concept we are discussing but in reality they would be firing on the enemy force. The illustration is only meant to show how the guns can cover the roads in a way to trap enemy forces on either side.

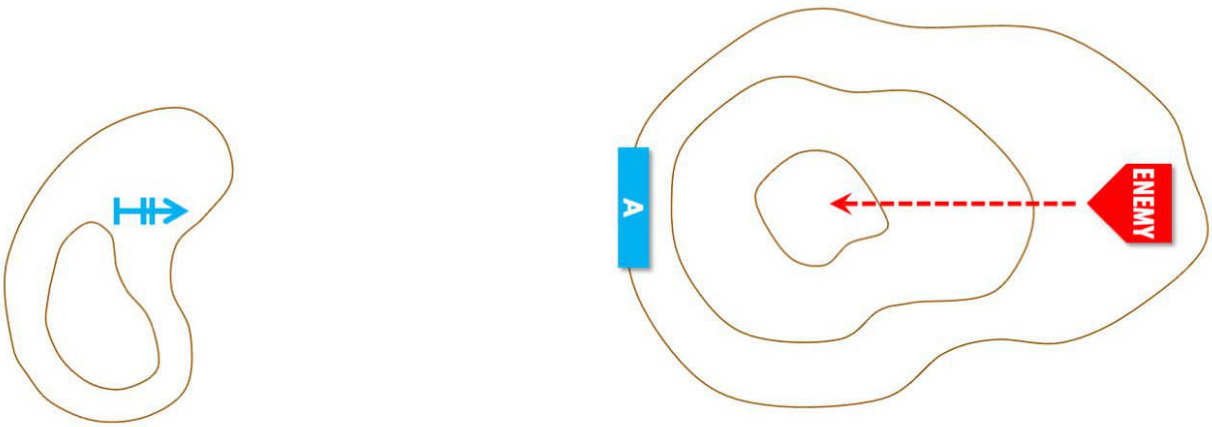


BATTLECRAFT: COVERING A REVERSE SLOPE DEFENSE

STEP 1: Set Up on the Reverse Slope

This technique shows how to use a machine gun to enhance a reverse slope defense which we discussed in our Squad Level Infantry Rural Combat book. Note that the reverse slope defense is particularly effective around the time of dawn, dusk or on nights when the sky is illuminated. During these times, the low ground is dark but it is easy to pick out silhouettes against the sky. In the example below, you set up on the reverse slope and wait in ambush for the enemy. The figure in the illustration is kneeling but in reality your force will probably be prone and behind cover. Note that the enemy cannot see you as they approach. You emplace a machine gun behind your reverse slope defensive position also facing the enemy.

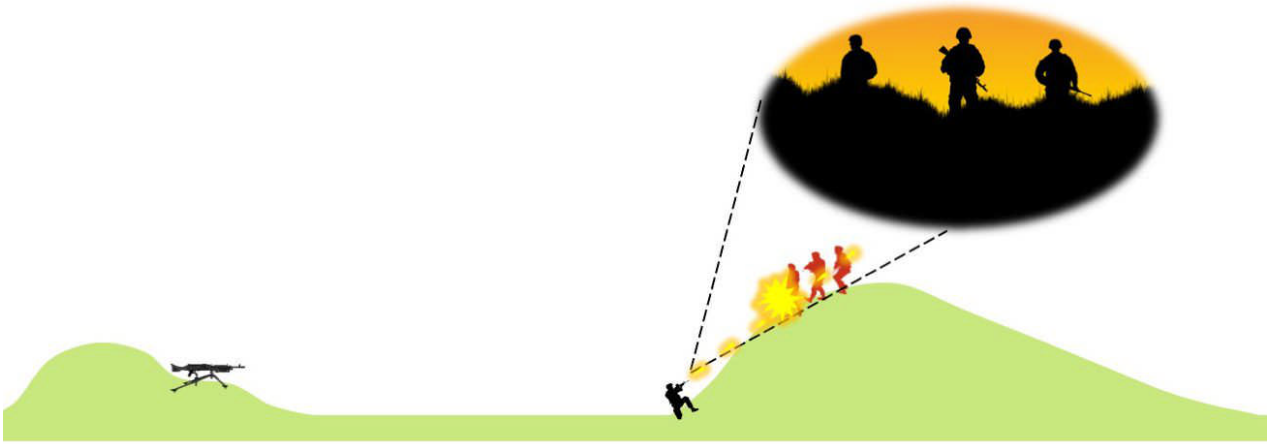


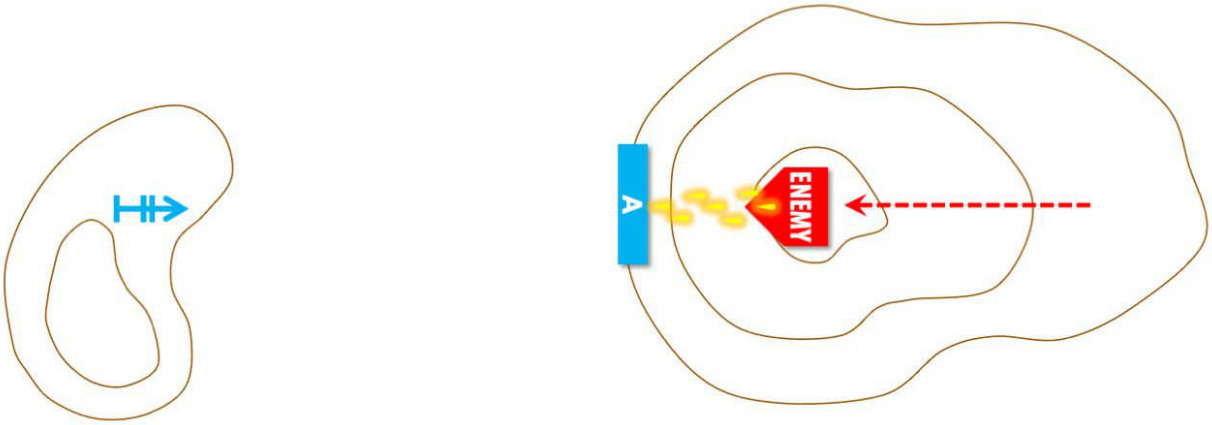


BATTLECRAFT: COVERING A REVERSE SLOPE DEFENSE

STEP 2: Engage the Enemy as He Crests the Hill

As enemies crest the hill, they silhouette themselves against the sky, making themselves easy to see and engage. You remain in the low ground where it is difficult for the enemy to spot you. This makes it almost certain that you will surprise the enemy. By the time the enemy sees you it is generally too late. As already mentioned, this technique can be effective against a larger force since only a portion of the force can crest the hill at any one time. You can engage the troops coming over the hill but any other enemy troops further back in the formation will still not be able to see you or engage you. When conducting a reverse slope defense, you must still be careful of enemy elements flanking around to attack you from the sides. In addition, the enemy can use the downhill momentum to assault your defensive position. Having the machine gun emplaced further back can help counter both of these contingencies.

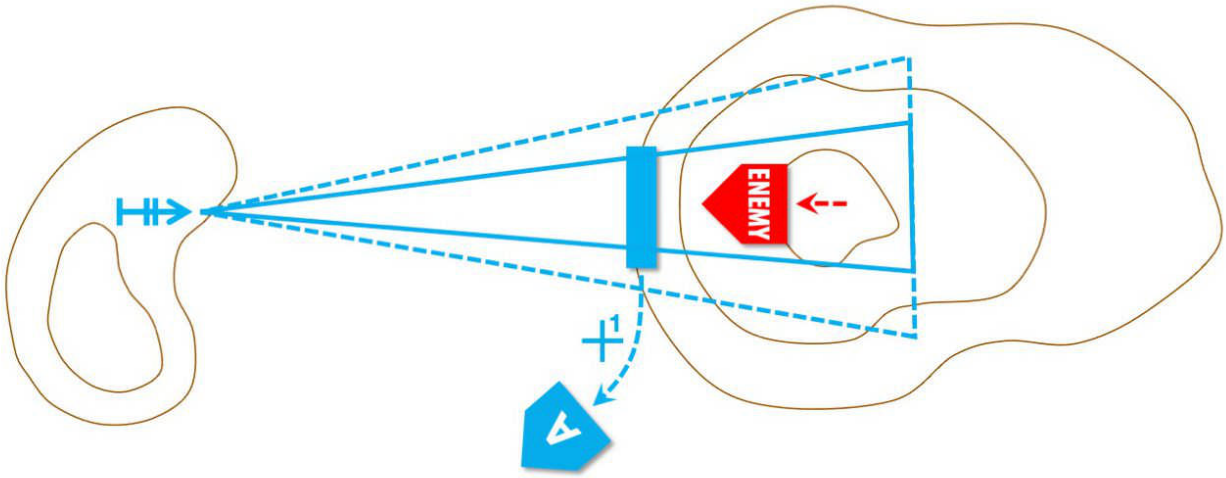




BATTLECRAFT: COVERING A REVERSE SLOPE DEFENSE

STEP 3: Move Defensive Element out of the Danger Zone

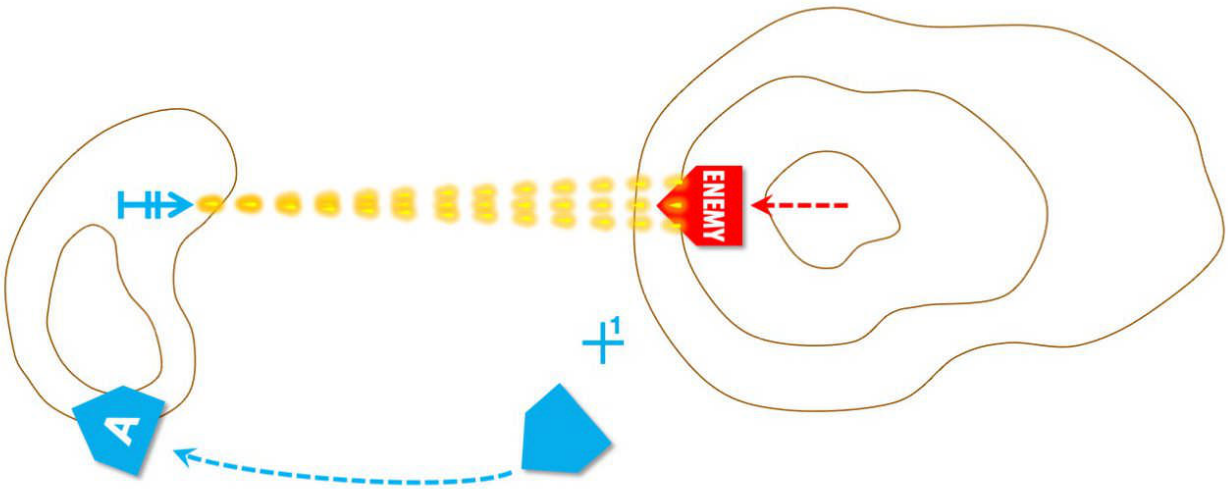
Before your machine gun can open fire, the defensive element on the reverse slope must move quickly to the left or right. Ideally, you should have already identified reference points on the ground so both the moving element and the machine gun will know when friendly troops are out of the danger zone. The diagram below applies the same 20-degree safety arc explained earlier in this book.



BATTLECRAFT: COVERING A REVERSE SLOPE DEFENSE

STEP 4: Achieve Plunging Fire with the Machine Gun

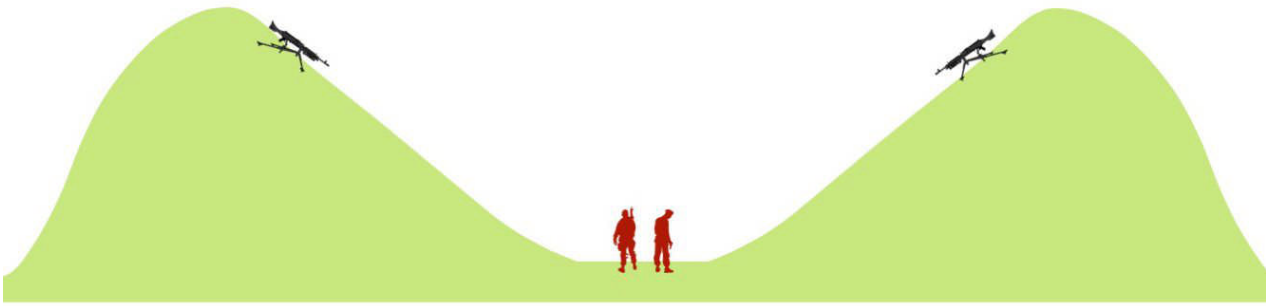
Once friendly troops are out of the machine gun's line of fire, the machine gun can engage enemy troops coming down the face of the hill. The machine gun's fire will be particularly effective since the gun will be able to achieve plunging fire on the advancing enemy. Having already suffered casualties from the reverse slope engagement, walking into the machine gun's beaten zone will further cripple the enemy force. This same technique can be used to react to enemies attempting to flank around the side of the hill after initially making contact with the reverse slope defense. The defending troops can break contact away from the flanking enemies and the machine gun can engage the enemy troops as they come around the side of the hill.

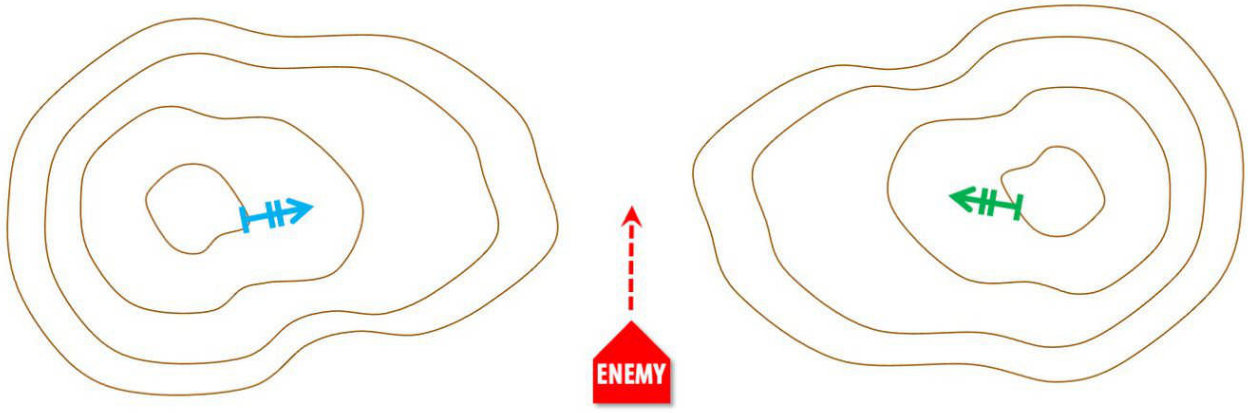


BATTLECRAFT: POSITIONING ON HIGH GROUND

STEP 1: Set Up Machine Guns Safely on High Ground

Positioning machine guns on high ground offers a number of advantages. First, it allows you to achieve plunging fire more easily and it can also increase the effective range of your fire. Second, it gives you more flexibility when it comes to danger zones and gun positioning. Ordinarily, you cannot have two guns firing on either side of the enemy the two guns might accidentally shoot each other. When firing from high ground, this rule can change.

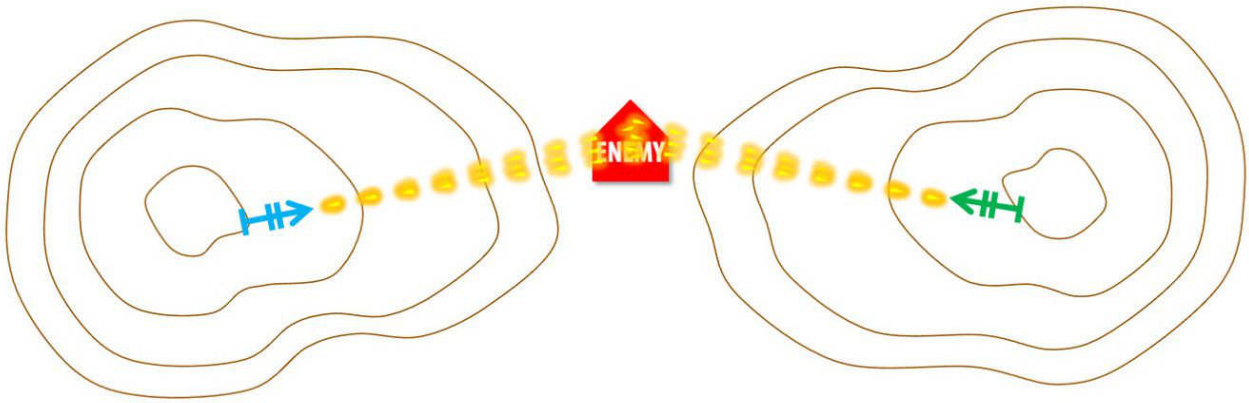




BATTLECRAFT: POSITIONING ON HIGH GROUND

STEP 2: Open Fire From Multiple Angles

In the example below, the two guns can safely open fire on the enemy even though they are facing each other because they are also both shooting down. This puts the enemy in a very difficult position, taking fire from each side. Depending on the terrain, it is also possible to put more guns into the fire from different angles. If a ridge wraps around the enemy in a U-shape, you might fire from each side and place an additional gun firing from the front. However, whenever firing from high ground it is important to factor in safety considerations. Depending on the range and angle of fire it is still possible for bullets to ricochet and hit friendly forces. Second, if the enemy decides to assault up hill towards one of the gun positions and the other guns continue to fire on the enemy, the fire might walk up the hill to a point where it is in danger of hitting friendly forces. Therefore, while firing from high ground can change the rules when it comes to danger zones, you still must be careful and establish additional control measures to ensure safety.



TRAINING GUN TEAMS
Training Subjects and Approaches

Some training approaches are more effective than others. So far this book has provided knowledge, tactics, techniques and procedures on machine gun employment but it has not discussed techniques for how to train a team or unit in those subjects. The topic of training methodology is very broad. Special Tactics has published additional books focused only on training methods and plans to publish more in the future. The goal of this section is just to provide a brief overview of some key training concepts and how they apply specifically to machine gun training. In addition, this section provides some specific ideas and suggestions that you can apply directly to your unit machine gun training program.

Assembly, Disassembly, Function and Maintenance

One of the most simple but effective components of machine gun training involves mastering the basics of machine gun operation and understanding the mechanics of how a machine gun functions or fails to function. These training subjects provide a useful focus points for units that have minimal range time or live-fire opportunities. One might ask how it is possible to become a better machine gun team without firing live bullets. The answer is that while there is no substitute for live fire training, there is a lot you can do to improve using an unloaded gun on the floor of the platoon office, company day room or battalion parking lot.

One of the first things many gunners and assistant gunners learn is how to assemble and disassemble their guns. Assembly and disassembly are tasks that can be easily practiced in a variety of engaging ways that will benefit more advanced training later on. While in some cases it can be useful to tie the assembly and disassembly training to a more complex mechanical context, it can sometimes be more fun just to focus on the physical tasks themselves in the context of a competition. Form a unit leaderboard and have a running competition to see who can assemble and disassemble the gun the fastest. A time trial would need to be supervised by

a team or squad leader with a timer and the board would be constantly updated with the latest top five or ten times to beat.

For fun, morale building training events leaders can stage face-offs between the top performer and the second-best performer on the leaderboard, forcing the two troopers to race under pressure. Ideally, all of this competition will encourage troopers to practice often, on their own and get to the point where assembling and disassembling the gun becomes completely second nature. At this point, leaders can organize additional training events that increase the challenge in various ways, forcing troopers to assemble and disassemble weapons blindfolded, in the dark, with added stress/distraction like noise, harassment or physical exertion.

Another very important component to incorporate into training is the "no notice" test. If troopers always know when they will have to perform a certain task and have time to prepare, they will not be as proficient as if they are tested frequently without warning. There are a number of ways to execute the no notice test. One technique is when troopers arrive in the morning, you can have a machine gun sitting on the floor. You can then call troopers into the room one by one and have them assemble and disassemble under time constraints. Another technique is to mix the parts of multiple different machine gun types in a box and cover the box with a tarp. You then pull away the tarp and start the stopwatch while troopers have to assemble multiple guns at once drawing from the mixed parts.

The same fundamental techniques that apply to assembly and disassembly apply to other aspects of weapon function and maintenance. Troopers can practice conducting functions checks, barrel changes, loading and unloading under time constraints, blindfolded and with added stressors. However, when it comes to some weapon function tasks like clearing malfunctions, it is very important to include blocks of instruction on how the weapon works and how certain malfunctions occur. If malfunction clearing is broken down into rigid, memorized drills, troopers will not understand how to clear more complex malfunctions. Instead, clearing malfunctions should be approached as a problem-solving or thinking exercise where troopers focus on the reason why they are performing certain actions, not just following a checklist.

Machine gun teams should approach weapon maintenance with the same level of focus as combat and marksmanship training. If possible, gunners and assistant gunners should cross train with experienced armorers to develop a deeper understanding of their weapons and how to maintain them. While gunners might not actually be certified as armorers, if they learn armorer skills on the job this can greatly improve field maintenance capabilities. Every gunner and assistant gunner must be constantly seeking to improve his/her knowledge of every aspect of the weapon system.

Crew Drills

As already discussed, crew drills focus primarily on placing the gun into action under pressure. Gun teams can train these drills using many of the same techniques already discussed for training assembly and disassembly. Gun teams can compete to see which teams can conduct crew drills the fastest. Trainers can then add additional variables and stress, forcing gun teams

to conduct crew drills blindfolded, in the dark, in the rain/mud, on rough/uneven terrain, in heavy brush, in extreme cold or heat, during physical exertion or with added stress. The goal is for gun teams to be able to complete the crew drill to standard, as quickly as possible under stress.

Leaders should take every opportunity to train under different conditions and types of stress. If it only snows in your area once or twice per year, on snow days everyone in the unit should want to stay at work as late as possible in order to take advantage of the opportunity to practice tasks and conduct training events in the snow. If troopers get cold and they start to lose finger dexterity, it is important to continue training so troopers can experience how the cold affects their ability to operate the machine gun. However, be sure to monitor troopers to ensure no one suffers a cold weather injury. This is just an example of the proper mindset for conducting crew drill training.

It is also extremely important to learn to conduct crew drills in the context of other combat maneuvers. Therefore, gun teams should practice placing their guns into action as part of larger squad-level or platoon-level fire and maneuver. If the entire squad or platoon is not available to train, the gun team can practice maneuvering on its own and conducting crew drills in response to notional enemy contact from different locations in different directions. These are just a few examples of ways to incorporate crew drill training into your machine gun training program.

Marksmanship

Marksmanship is an essential component of machine gun training. Unfortunately, for some units it can be more difficult to conduct effective marksmanship training because there will not be enough ammunition or range time for gunners to achieve true familiarity with their weapons. This means that whenever gunners get ammunition or range time they should take maximum advantage of the opportunity.

If gun teams simply conduct their required range qualification and then go home with rounds leftover, that is a tragic waste of training resources. Even worse, because turning in live ammo can be administratively tedious in some units, gunners will sometimes conduct a "spend-ex" where the goal is simply to fire off all the remaining ammunition to save time at the ammo supply point. To waste live ammo in this way is completely unacceptable and a strong indication that a unit has the wrong mindset when it comes to training.

Instead of just conducting the bare minimum required qualification/training on the range, leaders should try to come up with the most effective and realistic marksmanship training events that unit safety regulations will allow. If possible, even if the range is small, you can still practice incorporating crew drills and small maneuvers into marksmanship.

For example, leaders can set up a combination of different sized paper targets on the range. Then, two gun teams can move laterally down the range looking away from the target area so the targets configuration is a surprise. When a leader blows a whistle the gun teams will turn, identify the targets, place the guns into action and engage the targets as quickly as

possible, incorporating fire control measures like the talking guns technique, target reference points and fire commands etc. This drill may not meet the safety requirements of certain units but the idea is to make training as realistic as regulations will allow. The point is that the example drill above can be executed with no additional resources besides those available for a simple machine gun qualification.

The best opportunities are when the unit can access a larger machine gun range or live-fire maneuver range. When given the opportunity to fire at distances beyond grazing fire range, units should take the opportunity to practice as many long range engagement techniques as possible including plunging fire, indirect fire and defilade fire etc. Essentially, it is important to take advantage of the unique opportunity that is available. When given the opportunity to shoot at long range, focus on long range shooting while you have the space. When given the opportunity to practice fire and maneuver, try to get as much out of the training event as possible and focus on skills that you cannot practice on a smaller range or back in the battalion parking lot.

Physical Fitness

Physical fitness is an important part of machine gun training. Machine guns are heavy, difficult to carry for long distances, and difficult to carry when sprinting from cover to cover in a combat engagement. Even if gun teams are extremely proficient in marksmanship and operating their machine guns, that proficiency can degrade quickly with fatigue. This means that gun teams must be among the most physically fit members of a unit. Ideally, weapons squad leaders should tailor their squad physical training (PT) schedule to focus on fitness capability that supports effective machine gun employment. Special Tactics discusses more on how to tailor a combat-focused fitness program in our Comprehensive Combat Fitness manual.

In simple terms, machine gunners may need to focus more on muscular strength and muscular endurance than other unit members. In many cases it can be useful to select bigger, stockier, or stronger personnel for machine gun duty since they will be better able to carry the gun, tripod, and large ammunition loads. Running speed and cardiovascular endurance are always important but for gun teams, incorporating some strength training (weight lifting) and long range cross-country movement (rucking) with a heavy pack and a machine gun are essential.

The ultimate test of gun team physical fitness is their ability to effectively employ their machine gun when under realistic combat physical strain. This means that gun teams must spend a lot of time rucking, sprinting, climbing, and going from standing to prone to standing while carrying the machine gun, tripod, and ammunition. Such physical activities must be very familiar and not exhaust the gun team to the point where they become less effective. If possible, it is ideal to conduct or practice additional physical training on the range where gun teams can practice actually firing live rounds when they are out of breath and/or physically exhausted.

However, it is also important that not all marksmanship training should be conducted when troops are exhausted since this will detract from the effectiveness of the marksmanship

training itself. One technique is to conduct the first portion of the marksmanship training in a more controlled environment when troops are rested to focus on learning and technique, then put the troops through a grueling physical routine and practice a second round of shooting/drills when physically tired. Another technique involves going on a long ruck march prior to shooting at the range to practice shooting after the fatigue from a long movement.

Outcomes Based Learning

One important component for any combat training program is to ensure the training plan focuses on achieving desired outcomes in terms of combat effectiveness. Special Tactics has published another book focused entirely on Outcomes Based Learning that goes into much greater detail on the subject. For the purposes of this book our aim is only to introduce the concept and briefly discuss how it relates to machine gun training.

Outcomes Based Learning (OBL) means not focusing on a process but instead starting first with the outcome you are trying to achieve on the battlefield. Many training programs take the opposite approach, focusing on a specific process and following that process without thinking about how that process ultimately influences combat effectiveness. For example, some traditional machine gun training methods might involve learning to execute mechanical steps according to a rigid process or checklist and then meet clearly defined marksmanship standards firing at a paper target under minimal stress.

What are the outcomes of such a process-based training model? First, it teaches troopers to perform tasks in isolation, one at a time under controlled conditions. Second, it teaches troopers to passively receive information instead of proactively seeking knowledge for themselves. Third, it teaches troopers to follow rigid procedures or steps to the letter rather than learning to solve problems creatively. Finally, it teaches troopers to engage a paper, stationary target under minimal stress rather than learning to use the machine gun in a more realistic, high-stress combat environment.

It is obvious to see how training might be modified to achieve better combat-focused outcomes. For example, in combat troops will not perform tasks in isolation but will rather need to perform tasks unexpectedly and sometimes simultaneously under stress. Therefore, to achieve this outcome, instead of practicing machine gun tasks one at a time in a rigid predictable manner, it is better to force troopers to move from one task to another, never knowing what the next task will be. The troopers should conduct tasks like assembly, disassembly, crew drills, loading and unloading under realistic conditions and under stress. This achieves the desired outcome of teaching troopers to perform tasks without warning in stressful and unpredictable environments.

Another example of how to apply OBL concepts to machine gun training goes back to the example of learning to clear a malfunction. If instead of learning to clear a malfunction using a rigid process or set of steps, troopers approach the training as a problem-solving or thinking exercise, that will help build the attributes of creative thinking and problem-solving ability. Instead of just telling troopers what to do, trainers/facilitators should explain how the machine

gun works and then challenge troopers to figure out answers for themselves. This learning approach often proves to be much more effective. Troopers remember the training better, perform tasks better and learn problem-solving skills in the process. Once again, this is only a very basic summary of OBL concepts. For a more detailed discussion of OBL and how to apply OBL to various training and education activities, see the Special Tactics book entitled *Outcomes Based Learning Professional Handbook.*

FURTHER TRAINING
Courses and Resources

This book provides an overview of small unit machine gun employment. However, the book leaves many areas unexplored especially when it comes to other elements of infantry combat. There are a variety of other Special Tactics books, both current and in production, that are designed to complement this one. In particular, this book is designed to integrate with the Squad-Level Infantry Rural Combat book. There are additional infantry books soon to be published focused on platoon-level and company-level operations. For more information on these books please visit **www.specialtactics.me.**

Every Special Tactics book has a companion online course. If you cannot find the online course associated with your book that means it is still in production and has not yet been released. Visit our website to explore our growing selection of online courses. Online courses compliment the material covered in the books and present knowledge and information in a variety of multimedia formats including interactive presentations, animations, videos, and podcasts. All online courses also include interactive quizzes, tests and a serial-numbered completion certificate.

Finally, Special Tactics also offers in-person training. For information about upcoming courses or to request a custom course at your location please contact us on our website. If you have any other questions, comments or suggestions regarding this book, the Special Tactics staff welcomes you to contact us on our website at **www.specialtactics.me**. We look forward to hearing from you and hope you found this book worthwhile. Thank you for keeping our country and communities safe.